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NATIONAL AERONAUTICS AND SPACE AD[illegible]ATION

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INTRODUCTION

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Volume 9 Number 10 / May 23, 1971

TABLE OF CONTENTS

Subject Categories

Abstracts in the journal are grouped under the following categories: ***page:***

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion. **1491**

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **1492**

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems. **1495**

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology. **1496**

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences. **1503**

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants. **1511**

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation. **1516**

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics. **1526**

09 ELECTRONIC EQUIPMENT
Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation. 1530

10 ELECTRONICS
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories. 1536

11 FACILITIES, RESEARCH AND SUPPORT
Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations. 1537

12 FLUID MECHANICS
Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion 1539

13 GEOPHYSICS
Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences. 1545

14 INSTRUMENTATION AND PHOTOGRAPHY
Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras. 1556

15 MACHINE ELEMENTS AND PROCESSES
Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection 1562

16 MASERS
Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State. 1568

17 MATERIALS, METALLIC
Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see : 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics. 1571

18 MATERIALS, NONMETALLIC
Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics. 1587

19 MATHEMATICS
Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers. 1591

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences. 1595

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications. 1599

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems. 1601

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology, and 29 Space Radiation. 1605

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation. 1610

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems. 1626

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics. 1631

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems. 1637

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants. 1638

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear. 1640

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbits and trajectories. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles. 1642

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics. **1647**

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic. **1650**

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants. **1659**

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents. **1664**

SUBJECT INDEX I-1

PERSONAL AUTHOR INDEX I-65

CORPORATE SOURCE INDEX I-73

CONTRACT NUMBER INDEX I-89

REPORT/ACCESSION NUMBER INDEX I-93

ACCESSION/REPORT NUMBER INDEX I-105

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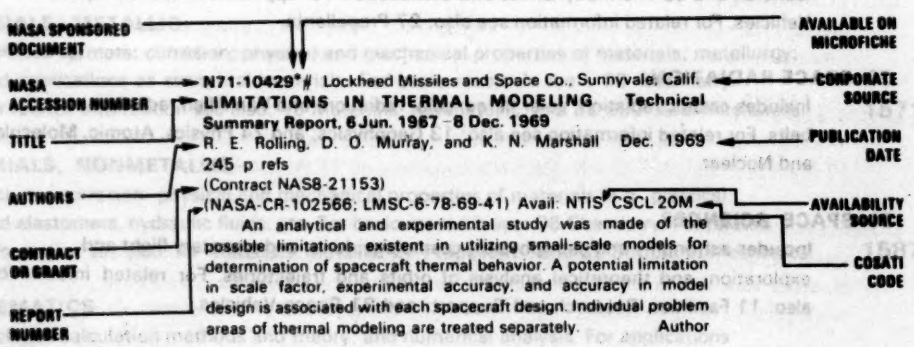
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N71-10429*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
LIMITATIONS IN THERMAL MODELING Technical Summary Report, 6 Jun. 1967 - 8 Dec. 1969
R. E. Rolling, D. O. Murray, and K. N. Marshall Dec. 1969
245 p refs
(Contract NAS8-21153)
(NASA-CR-102566; LMSC-6-78-69-41) Avail: NTIS CSCL 20M
An analytical and experimental study was made of the possible limitations existent in utilizing small-scale models for determination of spacecraft thermal behavior. A potential limitation in scale factor, experimental accuracy, and accuracy in model design is associated with each spacecraft design. Individual problem areas of thermal modeling are treated separately. Author

VOLUME 9 NUMBER 10 / MAY 23, 1971

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N71-20630*# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.

AN EXPERIMENTAL INVESTIGATION AND EVALUATION OF A DOPPLER RADAR TECHNIQUE FOR THE MEASUREMENT OF THE FLOW GENERATED BY WING TIP VORTICES Final Summary Report

William W. Joss, Hendrik W. Prinsen, and Calvin C. Easterbrook 20 Jan. 1971 55 p refs

(Contract NAS1-10290)

(NASA-CR-111877; CAL-AF-3015-C-1) Avail: NTIS CSCL 20P

Results are described of tests conducted to determine if radar reflective chaff injected at the wing tip of an aircraft would be ingested into the vortex structure and sufficiently distributed to allow velocity profiles to be measured by a Doppler radar. The results are presented in the form of flow field visualization results and an analysis of radar returns. The data show that individual chaff filaments dispensed at the wing tips of an Aztec aircraft are entrained by the wing tip vortices. An examination of the radar returns reveals the presence of large Doppler spreads in relatively small regions of the vortices. It was also found that a substantial percentage of the chaff had a tendency to form clumps which hampered the determination of the detailed velocity profiles. Author

N71-20685# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Aerodynamik.

A CRITICAL EXAMINATION OF THE EQUATION FOR THE DRAG OF THE KARMAN VORTEX STREET [KRITISCHE BETRACHTUNGEN DER FUER PERIODISCHE TOTWASSER GELTENDEN KARMANSCHEN WIDERSTANDSGLEICHUNG]

M. Tanner Jun. 1970 23 p refs In GERMAN; ENGLISH summary

(DLR-FB-70-27; AVA-FB-7007) Avail: NTIS; ZLDI Munich: 6 DM

The periodic wake behind bluff bodies is examined with special regard to the Karman drag equation. The assumptions of the Karman equation are inspected under new points of view considering the effect of the steady part of the base flow on the drag. This gives a new estimate for the vortex strength. The differences existing between the drag measured directly and that derived from the Karman equation are explained. Author (ESRO)

N71-20748*+ National Aeronautics and Space Administration, Washington, D.C.

AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, ANNOUNCED JANUARY–AUGUST 1970

Sep. 1970 1145 p refs

(NASA-SP-7037) Avail: NTIS HC $10.00/MF $0.95 CSCL 01C

Each entry in the bibliography consists of a standard bibliographic citation accompanied by an abstract. The coverage includes documents on the engineering and theoretical aspects of design, construction, evaluation, testing, operation, and performance of aircraft (including aircraft engines) and associated components, equipment, and systems. It also includes research and development in aerodynamics, aeronautics, and ground support equipment for aeronautical vehicles. Three indexes – subject, personal author, and contract number – are included. Author

N71-20766*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL INVESTIGATION OF THE EFFECT OF SCREEN INDUCED TOTAL PRESSURE DISTRIBUTION ON TURBOJET STALL MARGIN

James E. Calogeras, Charles M. Mehalic, and Paul L. Burstadt Washington Mar. 1971 55 p refs

(NASA-TN-X-2239; E-6981) Avail: NTIS CSCL 21E

The effect of several circumferential, radial, and combined distortions on the stall margin of a J85-GE-12 turbojet engine was investigated. The compressor was found to have a critical angle of circumferential distortion equal to 60 deg. For both single and multiple circumferential distortions, loss in compressor pressure ratio at stall was correlated with a simple distortion index based on the lowest mean pressure in any 60 deg sector of the compressor face flow field. Hub radial distortion was found to affect the pumping capacity and pressure ratio of the compressor, but not stall margin; however, tip radial distortion did affect the stall margin. The circumferential component of a combined pattern was generally found to be the predominant factor affecting stall margin. Author

N71-20847# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

LOW-SPEED WIND-TUNNEL TESTS ON A WING-FUSELAGE MODEL WITH AREA SUCTION THROUGH PERFORATIONS AT THE LEADING-EDGE FLAP KNEE

S. F. J. Butler and J. A. Lawford London Aeron. Res. Council 1970 59 p refs Supersedes RAE-TR-67153; ARC-29756

(ARC-R/M-3640; RAE-TR-67153; ARC-29756) Copyright. Avail: NTIS; HMSO: £1.50; BIS: $5.40

Distributed suction may be preferable to tangential blowing as a method of boundary layer control to achieve high lift for civil aircraft, because of its lower flow rates and power requirements. Tests using practical perforated suction surfaces at the knee of full span leading edge flaps are reported, for conventional hinged flaps and for an extending area arrangement having increased knee

radius. Stalling incidence increased progressively with suction rate. Flow requirements were insensitive to perforation arrangement and were little affected by simulated heavy rain; they were significantly reduced by increase of open-area ratio (with accompanying fall of plenum chamber depression and suction power) and increased by surface imperfections and intersurface leaks. Author (ESRO)

N71-20848# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

INTERFERENCE EFFECTS AT M = 8.5 OF WIRES AND PROBES ON THE WAKE OF A MAGNETICALLY SUSPENDED ROUNDED BASE CONE

J. F. W. Crane London Aeron. Res. Council 1970 25 p refs Supersedes RAE-TR-70023; ARC-32287

(ARC-CP-1133; RAE-TR-70023; ARC-32287) Copyright. Avail: NTIS; HMSO: 35p; BIS: $1.40

Transverse and axial probes and wires in the wake produce two types of interference with the wake. With transverse probes and wires the effect is to narrow the wake shock diameter and move its source downstream. With axial probes and wires there is an opposite effect. The former is apparent when the probe is within three base diameters of the model, and the latter is apparent when the edge of the viscous core is approached from within. Author (ESRO)

N71-21166# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MECHANICS OF CAPTIVE AERONAUTICS

B. I. Khalespskii 10 Nov. 1970 128 p refs Transl. into ENGLISH from Mono. Mekh. Priv. Vozdukhoplavaniy (Moscow), 1945 p 1–116

(AD-717015; FTD-MT-24-259-70) Avail: NTIS CSCL 1/1

Contents: Aerostatics; Aerodynamics; Lifting-operating characteristics of a balloon; Balloon dynamics. GRA

N71-21508*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio.

ANALYTICAL STUDY OF THE EFFECTS OF GEOMETRIC CHANGES ON THE FLOW CHARACTERISTICS OF TANDEM-BLADED COMPRESSOR STATORS

Nelson L. Sanger Washington Mar. 1971 62 p refs

(NASA-TN-D-6264; E-5876) Avail: NTIS CSCL 20D

The effects of changes in geometry on the performance of 15 tandem-bladed stators is reported. Five geometrical parameters were evaluated for flow only in the two-dimensional plane. Using results from this study a tandem blade was designed for which the analytically calculated loss was relatively small. A parameter that approximated the incidence of the mean flow on the rear blade showed an ability to identify effective tandem blade configurations. Boundary-layer calculations indicated that the shorter chord length tandem blade segments could not sustain as high a suction surface diffusion as conventional solid blade sections. Author

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N71-20617# Systems Technology, Inc., Hawthorne, Calif.

A PRACTICAL OPTIMIZATION DESIGN PROCEDURE FOR STABILITY AUGMENTATION Final Technical Report, Jan. – Nov. 1969

R. L. Stapleford, D. T. McRuer, L. G. Hofmann, and L. G. Teper Wright-Patterson AFB, Ohio AFFDL Oct. 1970 125 p refs (Contract F33615-69-C-1359)

(AD-717168; STI-TR-187-1; AFFDL-TR-70-11) Avail: NTIS CSCL 1/3

A systematic procedure for the design of aircraft stability augmentation systems is presented. The key features of this procedure are the selection of essential feedbacks from an examination of several handling quality metrics and the use of parameter optimization techniques to determine the numerical values of the SAS parameters. The optimization problem is structured to include both manual and SAS feedbacks. The cost function includes pilot tracking errors and SAS control deflections. A method of selecting the relative weighting is presented. The feasibility of this procedure is demonstrated by applying it to the longitudinal axis of the F-4 aircraft. Three widely different flight conditions are selected. For all three, the same SAS form (pitch rate and normal acceleration feedbacks to the elevator), the identical problem formulation, and the same method of selecting the cost function weights are used. The resulting systems are judged quite satisfactory and well within the short-period requirements of the current military handling qualities specification. Author (GRA)

N71-20719*# Scientific Translation Service, Santa Barbara, Calif.

CONTROL SYSTEMS FOR SINGLE-ROTOR HELICOPTERS

I. S. Dmitriyev et al Washington NASA Mar. 1971 325 p refs Transl. into ENGLISH of the "Sistemy Upr. Odnovintovykh Vertoletov" Moscow, Mashinostr., 1969 325 p

(Contract NASw-2035)

(NASA-TT-F-636) Avail: NTIS HC$6.00/MF$0.95 CSCL 01C

The theoretical foundations of helicopter stability, controllability, and maneuverability are discussed to the extent necessary for the design of control systems, with major attention being devoted to clarification of the physical aspects of the phenomena. Those characteristics of helicopter control systems which differentiate them from airplane control systems are examined. The optimal helicopter controllability characteristics, the rigid lifting rotor with control gyroscope, and the mathematical description of the pilot transfer functions in the closed loop helicopter control system are examined. Author

N71-20849# Royal Aircraft Establishment, Farnborough (England). Engineering Physics Dept.

AIRFLOW RATE REQUIREMENTS IN PASSENGER AIRCRAFT

E. A. Timby London Aeron. Res. Council 1970 30 p refs Supersedes RAE-TR-69228; ARC-31984

(ARC-CP-1136; RAE-TR-69228; ARC-31984) Copyright. Avail: NTIS; HMSO: 40p; BIS: $1.60

Airflow requirements for cabins of passenger transport aircraft are considered from the aspects of breathing, temperature control, odor control, pressurization, and equipment cooling. In supersonic aircraft the consequences of a pressurization failure and the requirements of equipment cooling are likely to prevent much reduction in airflow below current figures. In subsonic aircraft the airflow could be reduced for pressurization but is likely to be dictated by odor control on which information is lacking under representative conditions. The minimum engine air bleed rate would occur for a system which recirculates and purifies a proportion of the cabin air. Development of cabin air distribution systems would be required if airflow is to be reduced. Author (ESRO)

N71-20857# British Aircraft Corp., Filton (England). Electronics and Space Systems.

CONCORDE FLIGHT TEST INSTRUMENTATION

T. T. Walters 1970 34 p Presented at the 6th Intern. Aerospace Instrumentation Symp., Cranfield, Engl., Mar. 1970

(ESS/ES-13) Avail: NTIS

The equipment used for flight data recording in the Concorde prototype 002 is described and particular reference to the digital system which is used for the recording of quasistatic parameters is made. The major developments in the instrumentation for the preproduction aircraft are also described. Author (ESRO)

N71-20902# Aeronautical Research Council (Gt. Brit.).

CIVIL AIRCRAFT AIRWORTHINESS DATA RECORDING PROGRAMME. SPECIAL EVENTS RELATING TO AIRSPEED CONTROL AND HANDLING (JANUARY 1968 TO FEBRUARY 1969)

1970 41 p refs Supersedes RAE-TR-69238; ARC-32354 (ARC-CP-1135; RAE-TR-69238; ARC-32354) Copyright. Avail: NTIS; HMSO: 55p; BIS: $2.20

A small number of jet aircraft in normal airline service are fitted with recorders which produce continuous trace records of airworthiness data for 14 parameters. Throughout the recording period the records have been searched for unusual occurrences, and each one has been studied to determine its nature and, where possible, its cause. A selection of events relating to airspeed control and handling recorded between January 1968 and February 1969 is described. Author (ESRO)

N71-21169# National Transportation Safety Board, Washington, D.C.

MIDAIR COLLISION INVOLVING AMERICAN AIRLINES FLIGHT 30, BOEING 707-323 N7595AA AND LINDEN FLIGHT SERVICE CESSNA 150, N60942, AT EDISON, NEW JERSEY, 9 JANUARY 1971

3 Mar. 1971 12 p

(SB-71-28) Avail: Issuing Activity

The facts, circumstances, and conditions of a midair collision between a Boeing 707 and a Cessna 150 aircraft at Edison, New Jersey on January 9, 1971 are presented. The information is interim in nature pending completion of the investigation and issuance of a formal report. Author

N71-21205# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

SOME FLIGHT AND WIND-TUNNEL LONGITUDINAL STABILITY MEASUREMENTS ON THE BAC SLENDER-WING AIRCRAFT

C. S. Barnes and R. Rose London Aeron. Res. Council 1970 25 p refs Supersedes RAE-TR-70054; ARC-32330 (ARC-CP-1134; RAE-TR-70054; ARC-32330) Copyright. Avail: NTIS; HMSO: 35p; BIS: $1.40

Preliminary flight measurements of the longitudinal trim and dynamic stability of the BAC 221 aircraft have been made. The flight measurements are of reasonable quality in spite of difficulties associated with the aileron control system, an early instrumentation standard, and the handling characteristics of the aircraft at high incidence. Useful comparisons with wind tunnel results are made, and the agreement is generally reasonable, although some unexplained differences remain. Flight and wind tunnel tests to investigate the differences are planned. Author (ESRO)

N71-21223# Royal Aircraft Establishment, Farnborough (England).

ON THE EFFECT OF GUSTS AND CROSSWIND ON THE DYNAMIC RESPONSE OF AIRCRAFT IN THE LANDING APPROACH [BOENEINFLUSSE AUF DIE DYNAMIK EINES FLUGZEUG BEIM LANDEANFLUG]

P. Hamel et al Oct. 1970 33 p refs Transl. into ENGLISH of the publ. 'DGIR Jahrestagung 1969, Vortrag No. 52' (RAE-Lib-Trans-1524) Avail: NTIS

The response of a slender delta aircraft to vertical and lateral gusts has been investigated with the following results. (1) Steady sideslip—as in crosswind—produces strong inter-mode coupling which considerably alters the characteristics of the longitudinal short period and of the roll subsidence mode. (2) Wind shear in the earth boundary layer increases the sensitivity to lateral gusts. (3) It is possible to reduce the gust sensitivity both of the longitudinal and the lateral motion by suitable choice of aerodynamic properties. Simple criteria are given to define these conditions. Author

N71-21363# Army Aviation Systems Test Activity, Edwards AFB, Calif.

INVESTIGATION OF ENGINE RIGGING, AIRSPEED AND ROTOR RPM EFFECTS ON STEADY STATE AUTOROTATIONAL PERFORMANCE Final Report, Apr. 1968–Dec. 1969

John B. Fitch and John J. Shapley, Jr. Dec. 1970 35 p refs (AD-717047; USAASTA-70-23) Avail: NTIS CSCL 1/3

An investigation was conducted to define the effects of various airspeeds, rotor speeds, engine rigging and gross weights on a UH-1C helicopter during autorotation. Results of the investigation confirmed previous qualitative conclusions: that the use of low rotor speed to obtain maximum glide distance can be hazardous, especially at high gross weight conditions; and that current autorotation rate of descent information in operators manuals is insufficient for the operators use. The investigation further revealed that with a normal engine rigging, there is a measurable amount of engine output torque at low rotor speeds (310 rpm and below) during practice autorotations. This situation, encountered in a training environment, could produce a false sense of security in an individual faced with an actual emergency. Although the operational pilot cannot duplicate controlled test conditions, he should understand normal performance limits and the consequences of exceeding those limits. The report furnishes UH-1C autorotational data not currently available to the operator which should be incorporated into the appropriate manuals. Author (GRA)

N71-21607# National Transportation Safety Board, Washington, D.C.

AIRCRAFT ACCIDENT REPORT: PILGRIM AVIATION AND AIRLINES, INCORPORATED, DE HAVILLAND TURBO PROP DHC-6, N12PM, IN LONG ISLAND SOUND NEAR WATERFORD, CONNECTICUT, 10 FEBRUARY 1970

27 Jan. 1971 39 p

(NTSB-AAR-71-1; SA-418) Avail: NTIS

On February 10, 1970, Pilgrim Aviation and Airlines, Inc., scheduled air taxi Flight 203, a Turbo Prop De Havilland DHC-6, Twin Otter, N124PM, was ditched in Long Island Sound near Waterford Connecticut. The ditching occurred approximately 2 hours and 16 minutes after Flight 203 departed from Trumbull Airport, Groton, Connecticut, on an Instrument Flight Plan and clearance in instrument weather conditions for a scheduled flight to the John F. Kennedy International Airport, Jamaica, New York. The flight held in the New York area for an extended period, and then diverted to the Tweed Airport at New Haven, Connecticut, where it attempted and missed an instrument landing approach. At the time of the ditching, the flight was attempting to return to Trumbull Airport. Author

N71-21624# Civil Aeronautics Board, Washington, D.C. Bureau of Safety.

CIVIL AERONAUTICS BOARD ANNUAL REVIEWS OF US AIR CARRIER ACCIDENTS FOR CALENDAR YEARS 1938–1952

1971 498 p refs

(PB-196672; CAB-BOSR-38/52) Avail: NTIS HC $6.00/MF $0.95 CSCL 01B

Comparatively, significant factors surrounding accidents in U.S. scheduled air carrier passenger operations during the calendar

years 1951 and 1952 are reported. Detailed tabulations of accident causes, types, operational phases, etc., as well as pertinent charts, are appended. Each scheduled operator is shown in relation to the number of passengers and passenger miles flown, revenue plane miles flown, number of accidents, and resultant injuries, if any. Additionally, a composite tabulation is included which shows the division of these operations as follows: (1) domestic operations; and (2) international, U.S. flag. Author (GRA)

N71-21627# Texas Transportation Inst., College Station.
AIR TRANSPORTATION FOR TEXAS: COMMENTARY
John P. Doyle, Vergil G. Stover, John C. Goodknight, and Robert J. Hammons Aug. 1970 33 p
(PB-196932) Avail: NTIS CSCL 01B

The development of commercial air transportation for the state of Texas is discussed. Subjects presented are: (1) the state role, (2) inventory of facilities, (3) use of V/STOL aircraft, (4) development of transportation system, and (5) funding. Author

N71-21628# Texas Transportation Inst., College Station.
AIR TRANSPORTATION FOR TEXAS: WORK PLAN
John C. Goodknight and John P. Doyle Aug. 1970 94 p refs
(PB-196933) Avail: NTIS CSCL 01B

The research and development efforts anticipated and required for the preparation of the Texas Air Transportation Plan are discussed. The work plan is largely concerned with proposed procedures to be developed and used for the estimation of demand for air transportation services and facilities. The document treats three overall classes of demand: (1) commercial passengers, (2) air cargo, and (3) general aviation. Techniques suggested for forecasting demands use socioeconomic characteristics of the region as the basis for these estimates. The work plan identifies potential sources for such information and a tentative schedule for collecting these data and the generalized schedule for completion of the several phases of the Texas Air Plan Study. Author (GRA)

N71-21629# Texas Transportation Inst., College Station.
AIR TRANSPORTATION FOR TEXAS: AIRPORT INVENTORY
Robert J. Hammons and John P. Doyle Sep. 1970 22 p refs
(PB-196935) Avail: NTIS CSCL 01B

An inventory of existing airport facilities in the state of Texas is presented. Information from existing FAA airport records was compiled, coded and computerized. The results of this process furnished 942 pages of pertinent facts about the airports in Texas plus the capability for rapid retrieval of facts. In addition to a general listing, several other computer programs were written which provide listings of specific information of particular interest. Author (GRA)

N71-21630# Texas Transportation Inst., College Station.
AIR TRANSPORTATION FOR TEXAS: REFERENCE, 1970
John C. Goodknight and Gina Taylor Sep. 1970 81 p refs Prepared in cooperation with Tex. State Div. of Planning Coordination
(PB-196936) Avail: NTIS CSCL 01B

A compilation of references on the various aspects of air transportation for Texas is presented. Abstracts are included for a number of the individual references included in the listing. The document is organized according to the following topics: (1) aircraft, (2) airport, (3) bibliographies and reference lists, (4) commercial air carriers, (5) financing, (6) forecasts, (7) general aviation, (8) legislation and administration, (9) regional economic activity patterns and development, (10) regulation, (11) traffic control/nav aids, (12) travel patterns, and (13) V/STOL. Author (GRA)

N71-21632# Texas Transportation Inst., College Station.
AIR TRANSPORTATION FOR TEXAS: V/STOL APPLICATIONS, 1970
Robert J. Hammons and John P. Doyle Sep. 1970 23 p refs
(PB-196937) Avail: NTIS CSCL 01B

V/STOL as a transportation system and the applicability of such a system to air transportation in Texas is discussed. Background information justifying a need for V/STOL systems is discussed as is current and future V/STOL aircraft designs and fixed terminal facilities necessary to support the system. These criteria are then applied to air transportation needs in the state of Texas with emphasis on intermetropolitan area V/STOL systems. While such a system is feasible in the state, no accelerated activity is recommended for the present time. Author (GRA)

N71-21639# Mitre Corp., McLean, Va.
BRITISH AND AMERICAN TACV SYSTEM DEVELOPMENTS: TECHNICAL AND ENVIRONMENTAL FACTORS
C. G. Swanson, G. J. Easton (Tracked Hovercraft, Ltd.), and A. F. Lampros (Dept. of Transportation) Sep. 1970 78 p refs
(Contract OHSGT-7-35248)
(PB-196980; M70-47) Avail: NTIS CSCL 13F

Programs directed toward the development of tracked air cushion vehicle systems are described. The research programs are outlined and the results of transportation planning studies are presented. The environmental effects and the future prospects for this new transportation system are also discussed. Author (GRA)

N71-21663# Civil Aeronautics Board, Washington, D.C. Bureau of Safety.
CIVIL AERONAUTICS BOARD ANNUAL REVIEWS OF US AIR CARRIER ACCIDENTS FOR CALENDAR YEARS 1953 – 1957
1971 481 p refs
(PB-196673; CAB-BOSR-53157) Avail: NTIS HC $6.00/MF $0.95 CSCL 01B

Contents: U.S. air carrier accidents; General aviation accidents. GRA

N71-21665# Civil Aeronautics Board, Washington, D.C. Bureau of Safety.
CIVIL AERONAUTICS BOARD ANNUAL REVIEWS OF AIR CARRIER ACCIDENTS FOR CALENDAR YEARS 1958 – 1963
1971 469 p refs
(PB-196674; CAB-BOSR-58/63) Avail: NTIS HC $6.00/MF $0.95 CSCL 01B

The record of aircraft accidents, incident to flight, which occurred in U.S. Air Carrier operations during the calendar years 1958 – 1962 is reported. It includes a statistical recapitulation of all accidents, and a brief description of each accident along with the probable cause as determined by the Civil Aeronautics Board. Author (GRA)

N71-21676# Massachusetts Inst. of Tech., Cambridge. Engineering Projects Lab.
A PRELIMINARY STUDY OF ACTIVELY CONTROLLED AIR CUSHION VEHICLE SUSPENSIONS
David A. Hullender, David N. Wormley, and Herbert H. Richardson 15 Jun. 1970 161 p refs
(Contract C-85-65)
PB-196465; EPL-70-76110-11) Avail: NTIS CSCL 13F

The primitive vehicle suspension system coupling a simple vehicle model point contact with a two-dimensional guideway having random irregularities is defined. The optimum linear suspension which minimizes a linear combination of vehicle heave acceleration

(passenger comfort) and suspension-guideway displacement (suspension excursion) is synthesized using Weiner-Hopf filter theory. The mechanics of flexible base externally pressurized air cushion vehicle suspensions are discussed, including the use of a feedback control flow into the cushion region. Author (USGRDR)

N71-21707# Army Aviation Systems Command, St. Louis, Mo. Directorate of Flight Standards and Qualification.
A STUDY OF THE ARMY HOT DAY DESIGN HOVER CRITERION
Robert Bellaire and William Bousman Aug. 1970 118 p refs
(AD-717025; ADS-TN-68-1) Avail: NTIS CSCL 1/3

A study is presented of the Army hot day design hover criterion. Models are developed to represent rotorcraft, cost, environment and operation, and these models are integrated to examine the effectiveness and cost of the rotorcraft as a function of design altitude and temperature. Although no optimum design hover criterion can be derived, the effects of rotorcraft type and size, and performance degradation to be expected in the field are identified, and the appropriate range of design altitudes and temperatures are obtained. Author (GRA)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N71-20727*# Boeing Co., Seattle, Wash. Space Div.
LIGHTWEIGHT SOLAR PANEL DEVELOPMENT
Walter A. Hasbach Pasadena, Calif. JPL 15 Mar. 1971 36 p Prepared for JPL
(Contracts NAS7-100; JPL-952571)
(NASA-CR-117349; JPL-TR-32-1519) Avail: NTIS CSCL 10A

Technical information is reported concerning the preliminary design, analysis, fabrication, and test of a lightweight solar panel made of a built-up beryllium structure with an active cell area of 29 sq ft. Evaluations are presented of the results of the modal survey, reverberant acoustic, random vibration, sinusoidal vibration, static load, thermal-vacuum-shock, substrate frequency, and power output tests. Author

N71-20818*# Battelle Memorial Inst., Columbus, Ohio.
DEVELOPMENT OF IMPROVED PLAQUE MATERIAL FOR AEROSPACE NICKEL-CADMIUM CELLS Final Progress Report, 17 Nov. 1969 - 17 Nov. 1970
G. R. Schaer, F. Goebel, A. H. Reed, and J. McCallum 1971 62 p refs
(Contract NAS5-21105)
(NASA-CR-117482) Avail: NTIS CSCL 10A

Porous nickel electrodes were fabricated with a honeycomb structure providing direct connection of each pore to the surface of the electrode in order to extend the life of sealed nickel-cadmium cells. Procedures were developed for electroforming thin (0.2 to 0.4 mm) nickel foils with corrugations 3 to 10 mm wide, and for constructing mechanically strong honeycomb plaques from corrugated and flat nickel foils. Electrodes with five different pore sizes were fabricated and evaluated as rechargeable cadmium electrodes. Performance of the honeycomb electrodes showed a maximum capacity for pores of 4.2 mm diameter and a capacity similar to sintered nickel powder electrodes. Author

N71-20895* Space Technology Labs., Inc., Redondo Beach, Calif.
SOLAR CELL MOUNTING Patent
Le Roy Forehand and William H. Rodner, inventors (to NASA) Issued 10 Oct. 1967 (Filed 29 Nov. 1963) 3 p Cl. 136-89 Sponsored by NASA
(NASA-Case-XNP-00826; US-Patent-3,346,419; US-Patent-Appl-SN-327163) Avail: US Patent Office CSCL 10A

The fabrication of a bank of solar cells employing a means for attaching the solar cells to a base member or substrate is described. This is accomplished by interposing an electrically nonconducting board member between the solar cell and the base on which the solar cell is mounted. The board member has conductor strips on the side to which the solar cells are to be attached and the other side of the board member is attached to the base by means of a suitable adhesive. This type of construction results in a sandwich structure where the stresses generated because of the differences in coefficients to expansion of the solar cells and base are relieved and fracture of the solar cell is prevented. A further advantage lies in the fact that the conductor strips eliminates the necessity for wiring on the back sides of the solar cell and thus eliminates a time consuming and expensive hand wiring operation. In addition, the presence of the electrically nonconducting board member effectively insulates the solar cells from the base. Official Gazette of the U.S. Patent Office

N71-20904* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMBINED ELECTROLYSIS DEVICE AND FUEL CELL AND METHOD OF OPERATION Patent
Jacob Greenberg and Lawrence H. Thaller, inventors (to NASA) Issued 12 Dec. 1967 (Filed 4 Feb. 1964) 4 p Cl. 136-86
(NASA-Case-XLE-01645; US-Patent-3,357,862; US-Patent-Appl-SN-342574) Avail: US Patent Office CSCL 10A

The device includes the use of a molten salt capable of an electrolytic conduction, the imposition of a temperature gradient upon the molten fused salt, decomposition of the molten salt into its constituents by electrolysis and the use of these constituents in a fuel cell to produce useful power. Apparatus is provided for performing this method which includes a thermoelectric regenerative section, a fuel cell section, means for supplying the decomposed molten salt constituents to the fuel cell section and means for returning the fused salt to the regenerator section. Official Gazette of the U.S. Patent Office

N71-20925# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
DESIGN AND TEST OF THE SAS-A POWER SYSTEM
Ralph M. Sullivan May 1970 170 p refs
(Contract NOw-62-0604-c)
(AD-716771; APL-TG-1106) Avail: NTIS CSCL 10/2

The SAS-A power system consists of a solar cell array, a rechargeable nickel-cadmium battery, and two redundant charge control systems. The unique feature of this system is that there are a wide range of battery charge currents from the solar array, complicating the task of the charge control elements. The first part of the report describes the design of the power system with emphasis on the predicted solar cell array currents for different positions of the satellite with respect to the sun. The second part of the report presents the results of the power system test. Curves describing system operation are presented. A comparison between the two redundant charge control elements is made to show the advantages and disadvantages of each. A battery current and voltage limiter has the advantage of being simple and lightweight. However, the heavier electronic coulometer has the advantage of accommodating changes in the battery characteristics and of allowing more accurate predictions of the heat dissipated in the battery. Author (GRA)

N71-21206*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMAL CYCLING TEST OF A FLEXIBLE SOLAR CELL MODULE
A. F. Forestieri, A. F. Ratajczak, and T. M. Klucher Mar. 1971 15 p
(NASA-TM-X-52995) Avail: NTIS CSCL 10A

A thermal cycling test was performed on a representative module of a flexible rolled-up solar array. The experiment was designed to expose the module to temperature cycles between 87 C in simulated sunlight and −108 C in darkness at a pressure of 10 to the minus 7th power torr. Conditions were chosen to simulate the temperature profile the array would experience while in orbit. The test module was exposed to over 2000 such cycles. The results showed that changes in open-circuit voltage and short-circuit current were within measurement error. The cover glasses did not crack or delaminate and the soldered silver mesh interconnect did not fail. Stains were visible on the module and there was a very slight darkening of the fiberglass reinforcing in the Kapton substrate. This did not appear to affect performance. Author

N71-21511*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALOG COMPUTER STUDY OF DESIGN PARAMETER EFFECTS ON THE STABILITY OF A DIRECT ACTING GAS PRESSURE REGULATOR
Miles O. Dustin Washington Mar. 1971 45 p refs
(NASA-TN-D-6267; E-6015) Avail: NTIS CSCL 13G

An analog simulation of a spring-loaded, direct-acting, single-stage gas pressure regulator is presented. The simultation was based on a pressure regulator used in a solar Brayton Cycle space power generator. The effects of regulator design parameters on stability, transient response, and steady state accuracy were examined. Regulator stability was improved by increasing spring rate, decreasing sensing orifice size, and increasing output volume. The effect of adding an orifice in series with the metering poppet value was also investigated. A comparison was made between the dynamic performance of the simulated regulator and the actual Brayton cycle regulator. Author

N71-21512*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY THERMAL PERFORMANCE ANALYSIS OF THE SOLAR BRAYTON HEAT RECEIVER
Raymond K. Burns Washington Mar. 1971 41 p refs
(NASA-TN-D-6268; E-6042) Avail: NTIS CSCL 10A

The solar heat receiver, a combination heat exchanger and heat storage device, is designed to transfer 40 kilowatts of heat to the working gas of a Brayton engine. During a sun period of an Earth orbit, a parabolic collector is used to focus solar radiation into the receiver. Excess input solar energy is stored as heat of fusion of lithium fluoride and is withdrawn by the Brayton cycle during shade periods. The analysis predicted an acceptable variation in outlet gas temperature between 1490 and 1550 F (1080 and 1120 K) for a nominal design value of 1500 F (1089 K). Author

N71-21608# Oak Ridge National Lab., Tenn.
ISOTOPE KILOWATT PROGRAM Quarterly Progress Report, Period Ending 30 Sep. 1970
Dec. 1970 24 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-3214) Avail: NTIS

The design and fabrication of the shield block for a series of organic fluid capsule tests to evaluate the combined effects of temperature and radiation was completed. The radiation source has been prepared except for the closure weld for which a hot cell is scheduled. The materials for preparation of the fluid (a pure form of Dowtherm A) have been procured and several sample glass capsules have been fabricated. The detail design of the components for the organic fluid test loop has been initiated. A stainless steel Chempump of the proper capacity has been made available from another program that has been discontinued. The first tests of the aluminum screen thermal insulation−thermal fuse concept have been completed. Examination of the results indicates that the screen has sufficiently good insulating properties and yet will melt if the shield surface temperature rises to 1370 F, and thus it will provide the necessary safety provisions in the event of an accident that interrupts heat removal via the power conversion system. Author (NSA)

N71-21609# Oak Ridge National Lab., Tenn.
PERFORMANCE CHARACTERISTICS OF CYLINDRICAL HEAT PIPES FOR NUCLEAR ELECTRIC SPACE AND UNDERSEA POWER PLANTS
M. E. La Verne Jan. 1971 75 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-2803) Avail: NTIS

A preliminary investigation was made of the performance characteristics of cylindrical heat pipes with a view toward their incorporation as heat transport devices in nuclear electric space and undersea power plants, where reliable unattended operation is of prime importance. The basic operating principles of the heat pipe are summarized, together with an enumeration of the pertinent thermodynamic and transport fluid properties and a brief discussion of each. A number of capillary structures, of both the simple and composite type, is described and some of the advantages and disadvantages are delineated. The readily available heat pipe operating lifetime data are reviewed and are summarized in tabular form. The data show that the heat pipe is capable of the long-term reliability required for unattended operation. The theoretical bases for predicting several of the inherent heat pipe performance limits are reviewed and the resulting predictions compared with experimental data. The optimization of heat pipe geometry with respect to performance is shown for the situation where heat pipe output is not limited by compressibility or entrainment effects. The effects of several geometric and fluid parameters are examined, primarily by means of the theoretical relations previously obtained. Author (NSA)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N71-20612# Atomic Energy Commission, New York.
HEALTH AND SAFETY LABORATORY FALLOUT PROGRAM, APPENDIX Quarterly Summary Report, 1 Jun. 1 Sep. 1970
1 Oct. 1970 400 p
(HASL-237-App) Avail: NTIS HC$6.00/MF $0.95

Data from monitoring activities around the world are presented in tabular form. These data include: monthly deposition of Sr-89 and Sr-90 at world land sites, radiostrontium deposition at Atlantic Ocean weather stations, radionuclides in surface air over selected terrestrial and marine sites, and radiostrontium in milk and tap water in New York. Tables containing the conversion factors used in presenting the data and half-life values for the radionuclides of interest in the program are included. Author

N71-20615# Massachusetts General Hospital, Boston.
POSITRON SCANNING WITH COMPUTER INTERFACE Technical Progress Report, 1 Jan. −31 Oct. 1970

10 Nov. 1970 20 p refs
(Contract AT(30-1)-3937)
(NYO-3937-2) Avail: NTIS

The development of techniques and equipment for use in studies of pulmonary physiology and blood flow in other organs using positron cameras for scanning the short-lived cyclotron-produced radioisotopes C-11, N-13, and O-15 is reported. Emphasis was placed on the use of O-15 in the form of O2, CO, and CO2. A positron camera using two detector banks, each containing 127 crystals and 72 photomultiplier tubes, was developed for obtaining rapid sequential images. A computer data analysis system was developed for use with a hybrid scanner for brain tumor localization. The cyclotron production of O-15 by the N-14(d,n) O-15 reaction, N-13 by the C-12(d,n)N-13 reaction, and C-11 by the B-10(d,n)C-11 reaction is reported. Methods for the incorporation of O-15 in CO2, CO, H2O, and erythrocytes are described. Author

N71-20628# Naval Aerospace Medical Inst., Pensacola, Fla. Naval Aerospace Medical Research Lab.

THE EFFECT OF EARPLUGS ON PASSENGER SPEECH RECEPTION IN ROTARY-WING AIRCRAFT

Carl E. Williams, John R. Forstall, and Ward C. Parsons 27 Oct. 1970 14 p refs
(AD-716768; NAMRL-1121) Avail: NTIS CSCL 6/17

Direct person-to-person speech communication is sometimes required in rotary-wing aircraft where high levels of noise make the use of hearing protective devices desirable. The question arises as to what effect earplugs would have on the intelligibility of speech in rotary-wing aircraft. Intelligibility test data obtained in flight as well as in a simulated flight situation indicate that the use of earplugs in rotary-wing aircraft will improve the reception of direct person-to-person speech communication. Moreover, their use will afford protection against the deafening, fatigue, and annoyance effects of the hazardous noise present in rotary-wing aircraft. Author (GRA)

N71-20728# Texas Univ., Houston. Graduate School of Biomedical Sciences.

THE EFFECT OF RADIATION SENSITIVE MUTATIONS AND RADIATION ON RECOMBINATION IN PARTIALLY DIPLOID DERIVATIVES OF ESCHERICHIA COLI Progress Report

15 Sep. 1970 5 p
(Contract AT(40-1)-4024)
(ORO-4024-1) Avail: NTIS

Recombination was studied in diploids which carried two copies of the histidine operon with various mutational compositions. The purpose of the study was to introduce mutations effecting the dark repair system into partially siploid strains which contain mutations that are being converted or lost in the reciprocal products during recombinational events and to determine the effect of these ultraviolet-sensitive mutations on the frequency of gene conversion. Partially diploid derivatives containing the uvrA mutation were constructed and their genotypes are tabulated. A table is presented to show analysis of recombinants resulting from a limited number of spontaneous events occurring in the uvrA mutation. NSA

N71-20729# DuPont de Nemours (E.I.) and Co., Aiken, S.C. Savannah River Lab.

DEUTERATION IN SLOW NEUTRON RADIOGRAPHY OF BIOLOGICAL MEDIA

P. B. Parks, S. M. Reichard (Med. Coll. of Ga.), and M. Brown (Med. Coll. of Ga.) Jul. 1970 21 p refs
(Contract AT(07-2)-1)
(DP-1229) Avail: NTIS

Contrasts in slow neutron radiography of biological media can be improved by replacing hydrogen with deuterium in various tissues. Muscle and bone exposed to D2O readily exchange hydrogen for deuterium. If fully deuterated, their linear attenuation coefficients are reduced from approximately 3.4 and 2.3/cm to 0.5 and 0.5/cm, respectively. Fatty tissues, however, have little tendency to deuterate, and the linear attenuation coefficients remain approximately 3.5/cm. Slow neutron radiographs of deuterated-biological specimens show the fat distribution with contrasts exceeding those of conventional roentgenography. Calculations show that with a 50 to 70% hydrogen-deuterium exchange, slow neutron radiography of specimens as thick as the adult human arm or leg could be done without excessive radiation dose. However, clinical application of this technique cannot be recommended at this time because of the toxic effects of D2O. Author (NSA)

N71-20777# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

EVENTUAL WHOLE BODY EXPOSURE RATE FROM Kr 85 RELEASED TO THE ATMOSPHERE

M. M. Hendrickson 13 Jul. 1970 16 p refs Presented at Symp. on Environ. Aspects of Nucl. Power Stations, New York
(Contract AT(45-1)-1830)
(BNWL-SA-3233; CONF-700810-52) Avail: NTIS

The whole-body exposure rate for man was calculated for immersion in Kr-85 dispersed in the atmosphere. Both gamma rays and Bremsstrahlung were accounted for. Immersion exposure for one year to a semi-infinite cloud of Kr-85 with an activity concentration of 3 × 10 to the minus seventh power muCi/cu cm would result in a calculated dose of 7 millirem to the whole-body and 300 m rem to the skin (7 mg/sq cm depth). In numerous instances the above concentration has been equated to a whole-body exposure rate of 500 millirem per year when in fact this is the exposure rate of the surface of the body. Using currently popular estimates of the growth of nuclear power production, release of Kr-85 into the atmosphere could conceivably cause a total body dose (or genetically significant dose) of about 0.03 millirem in the year 2000. NSA

N71-20778# Naval Air Development Center, Johnsville, Pa. Aerospace Medical Research Dept.

COLONIC TEMPERATURE RESPONSE TO OXYGEN AT HIGH PRESSURE Interim Report

Edward H. Dench, Jr. and George H. Kydd 2 Dec. 1970 28 p refs
(AD-716985; NADC-MR-7011) Avail: NTIS CSCL 6/19

The colonic temperature of two groups of rats identified as to source were measured during repeated exposure to oxygen at high pressure (OHP) and compared with animals exposed to air at high pressure or air at barometric pressure. When exposed to OHD 60 PSIG for 30 minute exposures, the temperature decreases rather sharply (0.04C/min.) but tends to approach a limit before the decompression starts. After a period during which it is constant, it begins to rise again during the decompression but has not reached the initial value in an hour. There is a poor correlation between the occurrence of convulsions and temperature. One group of animals showed some adaptation with respect to temperature after several exposures. Author (GRA)

N71-20796# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.

COUNTING ACCELEROMETERS (AN ERROR ANALYSIS)

Gary F. Walker Aug. 1970 30 p refs
(AD-717151; ASD-TR-70-21) Avail: NTIS CSCL 1/3

Counting accelerometers are used on F/RF-4 aircraft as a part of the Aircraft Structural Integrity Program. The device counts and records the number of times four acceleration levels have been exceeded. The data are used with a fatigue analysis to determine fatigue damage on individual aircraft. The report presents the results of an error analysis of the counting accelerometer data and the fatigue analysis. Author (GRA)

N71-20990*# McDonnell Douglas Astronautics Co., Huntington Beach, Calif.

MEDICAL PROGRAM

J. R. Wamsley and D. J. Myers *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 495–515 (See N71-20951 10-05)

Avail: NTIS HC $6.00/MF $0.95 CSCL 06E

Medical procedures were planned to provide maximum data on crew medical status throughout the test within the constraints of limited pass-outs and onboard crew capabilities. These procedures and associated studies by outside investigators were accomplished without significant problems. Evaluation of the results confirm that the space station simulation environment was benign medically. Author

N71-20991*# McDonnell Douglas Astronautics Co., Huntington Beach, Calif.

MICROBIOLOGY RESULTS: DERMAL AND ENVIRONMENTAL SAMPLING

K. J. Levinson *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 517–529 (See N71-20951 10-05)

Avail: NTIS HC $6.00/MF $0.95 CSCL 06M

The 90-day space station simulation test offered unique opportunities for obtaining long term microbiological data in an isolated environment. An illustration of the sampling protocol utilized for the microbiology program is presented. Skin sites were swabbed weekly to determine potential shifts in normal microflora. No significant quantitative alternations were found and there were no observable shifts in predominant isolates. Reynier air samples and surface swab samples were used to obtain microbial counts and identification of predominant types. The predominant organisms in both of these types of environmental samples remained those carried by the crew members. An increase in number of types but not in number of viable particles in atmospheric samples coincided with catalytic burner shutdown and may be coincidental and unrelated to that occurrence. Author

N71-20992*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

NASOPHARYNGEAL STUDIES

Judd R. Wilkins *In its* Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 531–539 refs (See N71-20951 10-05)

Avail: NTIS HC $6.00/MF $0.95 CSCL 06E

Before and after the test and weekly during the test, nose and throat swabs from each crewman were cultured for Staphylococcus aureus, beta-hemolytic streptococci, Neisseria meningitidis, Diplococcus pneumoniae and Hemophilus influenzae. Beta-hemolytic streptococci were isolated from the throat of crewman 1 only on the fourth, 60th, and 67th days of the test. Neisseria meningitidis was recovered from the throat of crewman 3 during pretest sampling, throughout the 90-day test, and from posttest samples. This organism was also recovered from the throat of crewman 1 on the 25th and 32d days of the test. All four crewmen were healthy carriers of Diplococcus pneumoniae, and it was consistently isolated from the throat during the 90-day test. All attempts to recover Hemophilus influenzae failed, and no effort was made to culture this organism after the 53d day of the test. In the 90-day test there was no clinical illness related to the carriage or transfer of potentially pathogenic bacteria. Author

N71-20993*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

CHEMILUMINESCENT BACTERIAL SENSOR

Judd R. Wilkins *In its* Prelim. Results from an Operational 90-Day Manned test of a Regenerative Life Support System 1971 p 541–545 ref (See N71-20951 10-05)

Avail: NTIS HC $6.00/MF $0.95 CSCL 06M

The purpose of the chemiluminescent bacterial sensor experiment during the 90-day test was to determine: (1) if the sensor could rapidly detect gross contamination of recovered water; and (2) the correlation between sensor response and viable counts. The results showed good correlation between a strong sensor response and viable counts on eight occasions. In 60 tests the sensor response was strongly positive, and the plate counts were either negative or below the level of sensor sensitivity or were not performed. Because the sensor responds to living or dead cells, these results suggest that the recovered water may have contained: (1) dead bacterial cells; (2) porphyrins leached from cells; or (3) substances unrelated to bacteria which triggered a positive response. In general, the sensor was able to detect gross contamination rapidly, required minimum crew participation, and was easy to operate. Author

N71-20994*# McDonnell Douglas Astronautics Co., Huntington Beach, Calif.

RADIATION SAFETY REPORT ON THE USE OF (Pu-238)-O2 AS A HEAT SOURCE

A. A. Kelton *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 547–563 refs (See N71-20951 10-05)

Avail: NTIS HC $6.00/MF $0.95 CSCL 06R

Heat from five capsules containing Pu(238)O2 in the form of microspheres was used to power a water recovery subsystem in the 90-day manned test of a regenerative life support system in a space station simulator. Despite 76 manipulations of capsules at a whole body dose rate of 25 mrem/hr and the existence of a radiation area in a regularly traversed area of the SSS, the average integral exposure for 90 days of confinement was only about 100 mrem, less than 10 percent of the normally allowed dose. No discernible damage was sustained by any of the capsules, and no release of radioactive contamination could be detected. Several improvements in devices and procedures for the radiological safety of radioisotope power applications in manned spacecraft were identified. These studies indicate that current tendencies toward excessive protective measures may be unnecessary. Author

N71-20995*# McDonnell Douglas Astronautics Co., Huntington Beach, Calif.

BODY FLUID AND BODY COMPOSITION MEASUREMENTS

A. A. Kelton *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 565–572 ref (See N71-20951 10-05)

Avail: NTIS HC $6.00/MF $0.95 CSCL 06P

Measurements of plasma volume, blood volume, and total body water with radiopharmaceuticals, and also measurement of total body potassium by natural K-40 did not reveal any large changes in whole-body fluid compartments or lean body mass for the test or control subjects during the 90-day test in the space station simulator. Although the changes in body fluids and lean body mass were of marginal significance, the combined results are believed to reflect differences in the physical activity among the subjects. Author

N71-20996*# Naval Medical Research Inst., Bethesda, Md.

SOME BIOCHEMICAL DETERMINATIONS ON SERUM FROM CREWMEN PARTICIPATING IN A 90-DAY SPACE STATION SIMULATOR TEST

Edgar M. Neptune, Jr., Richard E. Danziger, Terry L. Sellee, and David E. Uddin *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 573–581 refs (See N71-20951 10-05)

Avail: NTIS HC $6.00/MF $0.95 CSCL 06P

Numerous alterations in the biochemical assays of serum were observed in the crewmen of the space station simulator during and after the 90-day test. These alterations are evaluated in relation to the mean pre-test values with each man serving as his own control. Although the test was judged to be totally benign by the medical staff, the biochemical alterations are tentatively attributed to either the exercise program or the psychological or other stress factors. Final interpretation must await evaluation of these data with the data obtained by other research groups involved in this study. Author

N71-20997*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
UTILIZATION OF THE V-V SPIROMETER LOOP TECHNIQUE FOR RESPIRATORY MONITORING
O. F. Trout, Jr., and T. O. Wilson *In its* Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 583–590 refs (See N71-20951 10-05)
Avail: NTIS HC$6.00/MF$0.95 CSCL 06P

The spirometer loop technique was successfully used in the 90-day manned test for respiratory monitoring. Only temporary small changes occurred in the respiratory systems of the test subjects during the test period. Because the technique is easy to use, requires very little time, and detects minor changes, it is recommended as a means of monitoring the subjects in subsequent reduced-pressure-atmosphere closed-chamber tests and space flights. Author

N71-20998*# Naval Medical Research Inst., Bethesda, Md.
BLOOD CARBOXYHEMOGLOBIN SATURATION OF PERSONNEL DURING 90-DAY TEST
F. Lee Rodkey, Harold A. Collison, and John D. O'Neal *In* NASA. Langley Res. Center Prelim. Results from an operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 591–597 refs (See N71-20951 10-05)
Avail: NTIS HC$6.00/MF$0.95 CSCL 06P

Hemoglobin solutions prepared from blood clots have been used to measure the COHb saturation of crew members during a ninety day test of a simulated space station life support system. The toxin burner was effective in removal of CO from the system as rapidly as it was produced by the crew. During a period of 313 hours when the toxin burner was not operated, a total of 739 ml of CO accumulated in the gas and blood. An average rate of endogenous CO production over this period of 0.59 ml per man hour was calculated. Author

N71-21041# Army Medical Research Lab., Ft. Knox, Ky.
GROWTH AND RECOVERY OF TEMPORARY THRESHOLD SHIFTS FOLLOWING EXTENDED EXPOSURE TO HIGH LEVEL, CONTINUOUS NOISE Interim Report
James D. Mosko, John L. Fletcher, and George A. Luz 24 Nov. 1970 14 p refs
(AD-717232; USAMRL-911) Avail: NTIS CSCL 6/16

A study was undertaken to evaluate the growth and recovery of temporary threshold shifts produced by extended exposure to simulated armored vehicle noise. Seventeen young adult males were continuously exposed to simulated armored vehicle noise over a 48-hour period. Auditory thresholds were obtained prior to exposure, during exposure, and after termination of exposure in order to permit the plotting of growth and recovery function for temporary threshold shift. Mathematical functions were used to describe the time-course of both the growth and recovery function. The data support the idea that an exponential mathematical function best describes both the growth and recovery functions for the temporary threshold shifts produced in this study. In addition, the data support earlier findings which indicate that an exponential model for temporary threshold shift is perhaps the most applicable model for use in designing dosimeters for noise exposure. Author (GRA)

N71-21081# Naval Aerospace Medical Inst., Pensacola, Fla.
THE NAVAL AVIATORS' SPEECH DISCRIMINATION TEST Progress Report
James W. Greene 29 Jun. 1970 12 p refs
(AD-716766; NAMRL-1110; NAVMED-MF12.524.005-7011B) Avail: NTIS CSCL 6/16

The document is concerned with the Naval Aviators speech discrimination test (NASDT) which is used to provide an objective basis for granting waivers to senior aviators who fail to meet the pure-tone hearing standards but who experience no hearing difficulties in their working environment. The test is also administered to groups of student aviators and participants in the Pensacola thousand aviator study. From an analysis of the data that have been obtained to date, it appears that the NASDT has fulfilled its original purpose and has led to a more realistic and practical evaluation of the hearing of senior naval aviators. Author (GRA)

N71-21082*# General Research Corp., Arlington, Va.
A SURVEY OF APPLICATIONS FOR TECHNOLOGY IN BIOLOGY AND MEDICINE
Richard R. Hibbard Oct. 1970 58 p refs
(Contract NASw-2053)
(NASA-CR-117487; WGRC-70-1953; CR-11180) Avail: NTIS CSCL 06B

An overview is presented of the interdisciplinary research of engineers, life scientists, and physicians. Much of the information presented comes directly from conversations with researchers and reflects what they believe to be the problems of medicine which engineers can aid in solving. Topics were selected to represent both the classes of problems identified and the categories of opportunities for engineering including artificial organs and assistive devices; automation of clinical laboratories; clinical instrumentation; hospital information systems; medical telecommunication; monitoring patients under intensive care; multiphasic screening; and prosthetics, sensory aids, and rehabilitation. Author

N71-21160# Naval Aerospace Medical Inst., Pensacola, Fla.
TWO PROCEDURES FOR APPLIED AND EXPERIMENTAL STUDIES OF STRESS
Robert S. Kennedy Feb. 1970 18 p refs Prepared jointly with Army Aeromed. Res. Lab.
(AD-716967; NAMI-1099; USAARL-70-11) Avail: NTIS CSCL 6/19

To compensate for the low reliability of physiological manifestations of sympathetic nervous system activity two methods are offered. The first method requires a major research program by which a valid criterion of stress would be determined by experimentation, and then predictors of this criterion would be obtained empirically by correlational techniques. These predictors could then be crossvalidated. By using the predictors, the influences of psychological stress and physiological stress could be separated. Whether a functional relationship exists between the magnitude of the response to stress and the probability of its occurrence could then be determined. The second method is similar but less exact. It has been used successfully in motion sickness studies and avoids the necessity of a long exploratory program with numerous pilot studies. A procedure for the control and the regulation of the perception of the magnitude of the stress to the organism (human and infrahuman) is offered for use with the two methods. The lack of suitable control of this factor is discussed in connection with previous research. Author (GRA)

N71-21167# Columbia Univ., New York. Radiological Research Lab.
RESEARCH PROJECT Annual Report
1 Jul. 1970 263 p refs
(Contract AT(30-1)-2740)
(NYO-2740-7) Avail: NTIS

Research in radiophysics, radiobiology, and biophysics is discussed. Dosimetry, microscopic distribution of radiation energy, and multiple Coulomb scattering and electron transport in tissue-equivalent gas mixtures are described. Genetic effects of neutrons and X-rays, relative biological effectiveness studies, theoretical radiobiology, and radiobiological studies with Cf-252 and synchronous cells are also reported. N.E.N.

N71-21222# California Univ., Los Angeles. Space Biology Lab.
EEG CONCOMITANTS OF EXPOSURE TO OSCILLATING ENVIRONMENTAL ELECTRIC FIELDS Final Report, 1 May 1967–30 Sep. 1970
W. Ross Adey 30 Sep. 1970 161 p refs
(Contract DADA17-67-C-7124)
(AD-717100) Avail: NTIS CSCL 6/16

A series of experiments has been done to assess effects of low-level (2.8 v.p-p. across 40 cm), low-frequency (7 and 10 Hz) electric fields on behavior and electrical brain activity of monkeys. Monkeys were implanted with cortical and subcortical EEG electrodes and then trained to perform a precise behavioral task (a five sec. fixed interval, limited hold scheduling of rewards for lever pressing). After the animals were well trained, they were tested in a set of 4-hour experiments with fields on and fields off. Behavioral inter-response time distributions shifted in the direction of significantly faster responses under the 7 Hz fields. Peaks in power of EEG autospectra were observed at the frequency of the field in certain brain structures, especially the hippocampus. Other experiments evaluated length of exposure to fields, EEG changes with fast and slow responses, effects on sleep patterns and effects on evoked visual responses in cats. EEG was monitored from monkeys during exposure to amplitude modulated (5-15 Hz) and unmodulated microwaves. Results suggested an interaction of modulated microwaves with certain brain structures. However, the question of rectification effects at the electrode-tissue interface was left unanswered. Author (GRA)

N71-21333 Ohio State Univ., Columbus.
THE EFFECTS OF A SPACE-CABIN ENVIRONMENT ON THE IMMUNE RESPONSE
Robert Vincent Coyne (Ph.D. Thesis) 1969 74 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 70-6752

The effects of a simulated space-cabin atmosphere (100% oxygen at 5 psia) on the immunological response in mice were investigated. Primary and secondary responses were studied relative to changes in spleen weight, antibody titer and to the histochemical and biochemical activities of oxidative enzymes and acid phosphatase in the spleen following stimulation with killed Brucella abortus antigen. Animals were maintained in normal room atmosphere (room controls), in an environmental dome under normal atmospheric conditions (dome controls) or exposed to 100% oxygen at 5 psia or 7.5 psia in an environmental dome either before or after antigenic stimulation. Dissert. Abstr.

N71-21401 National Lending Library for Science and Technology, Boston Spa (England).
CONCERNING THE POSSIBILITY OF SELF-OSCILLATION ARISING IN ENZYMIC REACTIONS WITH SUBSTRATE AND PRODUCT INHIBITION [O VOZMOZHNOSTI VOZNIKNOVENIYA AVTOKOLEBANII V FERMENTATIVNYKH REAKTSIYAKA A SUBSTRATNYM I PRODUKTNYM UGNETENIYAMI]
E. E. Selkov Aug. 1970 22 p refs Transl. into ENGLISH from the Publ. 'Kolebatelnye Protsessy v Biolog. i Khim. Istemakh, VSES Simpoziuma, 21–26 March 1966' Moscow, 1967 p 93–112
(NLL-RTS-5991) Avail: Natl. Lending Library, Boston Spa, Engl.: 44s; 7 NLL photocopy coupons

A kinetic model is described for open monomolecular reactions, the enzyme for which is inhibited simultaneously by the substrate and the product. In reactions which correspond to this model, mathematical analysis shows that self-oscillation of the reagent concentration must occur under certain conditions. The model is useful in explaining the periodical processes which are frequently observed in various biochemical processes. Author

N71-21472# Joint Publications Research Service, Washington, D.C.
PHYSIOLOGICAL CHANGES IN DIVERS WORKING UNDERWATER
S. A. Gulyar et al 23 Mar. 1971 9 p refs Transl. into ENGLISH from Fiziol. Zh. (Kiev),
(JPRS-52697) Avail: NTIS

Respiration, blood circulation, and energy functions were measured on divers wearing aqualungs and working in an underwater drilling facility to investigate work-rest cycles. Subjects were eight healthy males aged 19 to 30 who performed the following tasks: equipment operating, rod replacement, disconnecting ground probes, drilling using an air hammer and crow bar, and connecting and disconnecting hoses and pipes. Results reveal that underwater drilling work in a low temperature environment brings about significant changes in the circulatory and respiratory systems and the thermoregulation mechanism. Tasks are more difficult to perform than on land. A 15-minute rest period after work does not fully restore physiological functions to normal levels. E.C.

N71-21485# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
UTILIZATION OF COHERENT OPTICS IN THE OPTIMIZATION OF RECOGNITION
Kenneth G. Leib and Benjamin J. Pernick Mar. 1971 80 p refs
(RM-498) Avail: NTIS

The premise that certain coherent optical systems are capable of directly linking together the visual response of the human eye and visual stimuli is studied. The hypothesis is that by matching the spatial frequency response of the eye of an observer to the optical frequency spectrum of the visual pattern observed, recognition will be optimized for that observer. The ability to distinguish between visual symbols and to measure the level of similarity could also be achieved. This quantitative measurement would be derived from laboratory findings rather than from statistical subject test evaluations. Pertinent characteristics of coherent optical correlation and frequency analysis as applied to the human eye are discussed. Applications of these techniques to the improvement of display legibility and to education research in reading are presented. Pilot psychological tests with a small adult sample have shown that such laboratory measurements are meaningful and could be used to predict human factors test results in similar applications. A collection of optical spatial frequency patterns for some basic geometric shapes and alphanumeric codes is included. Author

N71-21509*# California Univ., Berkeley. Lawrence Radiation Lab.
OBSERVATIONS BY HUMAN SUBJECTS ON RADIATION-INDUCED LIGHT FLASHES IN FAST-NEUTRON, X-RAY, AND POSITIVE-PION BEAMS
C. A. Tobias, T. F. Budinger, and J. T. Lyman Aug. 1970 16 p
(NASA Order L-43541; Contract W-7405-eng-48)
(NASA-CR-U7495; UCRL-19868) Avail: NTIS CSCL 06P

In order to examine the hypothesis that light flashes seen by astronauts on lunar missions are the result of primary cosmic particles, two human subjects were exposed to a fast-neutron beam (20 MeV to 640 MeV) at the Berkeley 184-inch cyclotron. Both subjects saw 25 to 50 discrete pinpoint bright momentary light flashes in response to a flux of (10 to the 4th power per square

centimeter per second) (1 mrem dose). The star-like phosphene phenomenon in the neutron exposure is different from X-ray induced radiophosphenes and from electrically produced visual flashes. No visual phenomenon was noted on positive pi meson exposure at 200 neutrons (per square centimeter per second). It is believed that bright flashes seen by astronauts are from primary cosmic particles traversing the retina. The mechanism is probably ionization, although light from Cherenkov effect has not been ruled out. Author (NSA)

N71-21526# Argonne Cancer Research Hospital, Chicago, Ill.
EFFECTS OF HYPERTROPHY AND HYPOXIA ON THE TURNOVER OF MYOCARDIAL COMPONENTS
Murray Rabinowitz, Radovan Zak, Vaclav Aschenbrenner, and R. Albin 1970 28 p refs Presented at Symp. on Cardiac Hypertrophy, Bratislava Sponsored in part by AEC and Chicago and Ill. Heart Assoc.
(Grants PH-43-68-133; HE-9172; HE-4442)
(ACRH-1000-214; CONF-700936-1) Avail: NTIS

It is shown that myofibrillar proteins and mitochondrial components turn over rapidly within the cardiac muscle cell. Myofibrillar proteins and the inner mitochondrial membrane each appear to turn over synchronously. Acute cardiac hypertrophy results in increased synthesis of these components but mitochondrial mass increases disproportionally greater than other cell proteins early in the process. The rate of myosin destruction is decreased after aortic constriction. Similarly the increase in mitochondrial mass caused by thyroid administration is accompanied by a decreased mitochondrial turnover. However immediately after aortic constriction there may be a considerable increase in mitochondrial turnover during the phase of rapid synthesis. Hypoxia leads to a selective destruction of mitochondria, which are rapidly resynthesized following return to normal oxygen tension. Myofibrils and membranes are more resistant than mitochondria to the effect of hypoxia. Author

N71-21527# Oregon State Univ., Corvallis. Dept. of Biochemistry and Biophysics.
PROPERTIES OF ENZYMES FROM THERMOMORPHS AND HALOPHILES Progress Report, 1 Apr. 1968 - 15 Dec. 1970
R. R. Becker 15 Dec. 1970 14 p refs
(Contract AT(45-1)-2059)
(RLO-2227-T-5-1) Avail: NTIS

Research is reported on enzymes from H. salinarium, B. stearothermophilus, and Vibrio marinus. By including Mn(2+) in the isolation procedure, it was possible to isolate small quantities of alkaline phosphatase of H. salinarium. Difficulties in purifying and characterizing enzymes from B. stearothermophilus and Vibrio marinus are briefly described, and the present state of knowledge in the area of thermophilic proteins is reviewed. N.E.N.

N71-21535# California Univ., Livermore. Lawrence Radiation Lab.
SPECTRA OF THE PHOTOCONDUCTIVITY OF GREEN LEAVES AND CHLOROPLASTS AT A FREQUENCY OF 10 TO THE 10th POWER CYCLES PER SECOND
L. A. Blyumenfeld et al Oct. 1970 6 p refs Transl. into ENGLISH from Dokl Akad. Nauk SSSR (Moscow), v. 193, 1970 p 700-702 In ENGLISH and RUSSIAN Sponsored by AEC
(UCRL-Trans-1427) Avail: NTIS

In order to understand the mechanism of the light stage of photosynthesis, it is necessary to establish if such charges actually form in photosynthesizing systems. The most direct answer to this question can be given by measurements of photoconductivity at such frequencies at which the diffusion displacement of the photocarriers for the field period is small in comparison with the dimensions of the conductive areas. This requirement is satisfied by a range of 10 to the 10th power cycles per second. The measuring of photoconductivity at superhigh frequencies consists in determining the imaginary part of the dielectric constant of a sample under light. The system of automatic frequency control which compensates for the shifting of the resonator's own frequency under light makes it possible to measure separately the imaginary part of the dielectric constant. Author

N71-21558*# North American Rockwell Corp., Downey, Calif. Space Div.
A STUDY OF HUMAN PERFORMANCE IN A ROTATING ENVIRONMENT
J. A. Green, J. L. Peacock, and A. P. Holm 1970 245 p refs
(Contract NAS1-9711)
(NASA-CR-111866; SD-70-456) Avail: NTIS CSCL 05E

The overall impact of artificial-gravity simulations on potential design configurations and crew operational procedures is discussed. Gross locomotion and fine motor performance were evaluated at rotational rates of 3, 4, and 5 rpm, at selected radii between 0 and 78 feet. The test series consisted of 12 one-day, 1 three-day, and 1 seven-day test. Results of these evaluations indicate that crew orientation, rotational rates, vehicle design configurations, and operational procedures may be used to reduce the severity of the adverse effects of the Coriolis and cross-coupled angular accelerations acting on masses moving within a rotating environment. Results further indicate that crew selection, motivation, and short-term exposures to the rotating environment may be important considerations for future crew indoctrination and training programs. Author

N71-21576# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
EXTERNAL SPACECRAFT CONTAMINATION MODELING AND COUNTERMEASURES
T. Baurer, M. H. Bortner, I. M. Pikus, and A. M. Cooper Jun. 1970 85 p refs
(Rept-70SD260) Avail: NTIS

The causes and counteractions for spacecraft external contamination are discussed. The relevant phenomenology may be conceptualized in a model which assumes that a mass transfer mechanism is operative, including sources, transport modes, and sinks. Typical sources include engine debris, jettisoned wastes, outgassing, and cabin leakage. Three complementary approaches to the problem of counteracting contamination are presented. Author

N71-21598*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
DYNAMIC MODELS OF THE HUMAN BODY Technical Report, Sep. Sep. 1962 - Feb. 1964
Ernest L. Stech and Peter R. Payne Wright-Patterson AFB, Ohio AMRL Nov. 1969 59 p Prepared by Frost Eng. Develop. Center
(Contract AF 33(657)-9514)
(NASA-TM-X-67038; AD-701383; AMRL-TR-66-157) Avail: NTIS CSCL 6/2

Some of the dynamic characteristics of the human body were analyzed and mathematically analogs that can be used to predict the response of the body to acceleration environments were developed. The background of the acceleration tolerance problem, the basic concepts of body dynamics and the available experimental data were also reviewed. Both spinal and transvers dynamic models are presented together with the data used in obtaining frequency, damping, and breaking strength estimates. A discussion of the factors influencing the production of injury from exposure to accelerations is presented to indicate the difficulty in defining human tolerance to acceleration using the classical approach of graphs or simple critical G values that depend only upon the duration of the acceleration. The concept of relative probability of injury is developed in order to take into account the variations in the human structure and other factors that influence human tolerance to accelerations. Author (GRA)

N71-21601# California Univ., Livermore. Lawrence Radiation Lab.

FORTRAN CODE FOR THE ANALYSIS OF COUNTING DATA FROM ANIMAL TISSUES

W. H. Martin, D. G. Fleshman, and A. J. Silva 16 Oct. 1970 28 p refs Sponsored by AEC

(UCRL-50957) Avail: NTIS

A Fortran code designed to run under the monitor system of the CDC 6600 computer was developed for processing counting data from studies involving the metabolism of radionuclides in animals. The mathematics and input parameters necessary to reduce these data are presented. The program applies calculations required to derive uptake, retention, distribution, and excretion data from animals which were administered radionuclides. Author (NSA)

N71-21610# Joint Publications Research Service, Washington, D.C

PHYSICOCHEMICAL SIMULATION OF PROCESSES OF INFORMATION AND THINKING

N. I. Kobozev 25 Mar. 1971 12 p refs Transl. into ENGLISH from Zh. Fiz. Khim. (Moscow), v. 44, no. 12, 1970 p 2969-2974

(JPRS-52722) Avail: NTIS

In terms of the thermodynamics of strongly degenerate Fermi-Dirac gas, a low-entropy system of superlight particles was calculated, capable of producing with a small degree of error some prelogical informational functions of the brain and consciousness (under normal temperature). The superlight particles are actually fermions with low intraparticle density. Even at a low concentration they can create in the nerve cell network a low-entropy information apparatus capable of allowing less than one error in 1,000 operations. The small mass of the particles determines their great phase wave as well as their time variable ambiguity. This makes it possible for microparticles to absorb the flow of information earlier in time and farther in space than the biochemical cell material is able to. Without such an informational lead, living cells could not endure the competition against a mass of dead substance. Author

N71-21621# Texas Univ., Austin. Electronics Research Center.

EVOKED POTENTIALS FROM THE LASER-IRRADIATED RETINA

Franklin G. Hempel and Ashley J. Welch 20 Mar. 1970 170 p refs

(Contract DAAB07-68-C-0319; Grant AF-AFOSR-1792-69)

(AD-717166; TR-83; AFOSR-70-1872TR) Avail: NTIS CSCL 6/3

The document is concerned with the effect of retinal photocoagulation on the light evoked electrical responses of the visual system. Research was conducted to examine the electroretinogram (ERG) and the lateral geniculate nucleus (LGN) and striate cortex potentials of the rabbit before and after irradiation of the retina with a high-energy ruby laser. Protocol consisted of recording the three potentials while stimulating the eye with an argon laser operated at several flash intensities, exposing the retina to a calculated ruby laser radiation dosage, and recording again the responses to photic stimulation. Author (GRA)

N71-21640# Federation of American Societies for Experimental Biology, Bethesda, Md.

EFFECT OF GRAVITATIONAL OVERLOADS ON INNERVATION OF THE AORTA, VENAE CAVAE, AND ATRIA

M. G. Prives et al 1971 9 p refs Transl. into ENGLISH from Arkh. Anat., Gistol. i, Embriol. (Moscow), v. 58, n. 5, 1970

(PB-197016T; NS-362) Avail: NTIS CSCL 06S

Investigations have demonstrated structural changes in blood vessels exposed to gravitational overloads in various directions. Changes observed in the vessels and their walls are unquestionably accompanied by morphological changes in their neutral components. The results of an investigation of nerve endings in the atria, aorta, and venae cavae are described and correlated with the degree of physiological stress on the cardiovascular system during exposure to continuously increasing centrifugal acceleration. Material for investigation was obtained for 19 dogs in four series of experiments. GRA

N71-21650# Naval Aerospace Medical Inst., Pensacola, Fla. Research Lab.

RELIABILITY AND VALIDITY OF THE BRIEF VESTIBULAR DISORIENTATION TEST COMPARED UNDER 10 rpm AND 15 rpm CONDITIONS

Rosalie K. Ambler and Fred E. Guedry, Jr. 14 Aug. 1970 14 p refs Joint Army-Navy report

(AD-716767; NAMRL-1115; USAARL-71-7) Avail: NTIS CSCL 6/16

A Brief Vestibular Disorientation Test (BVDT) was developed that involves observer assessment of subjects reactions produced by head movements in a rotating chair. Reliability of observers has been demonstrated, and significant validation and cross-validation coefficients have been reported for criteria of pass versus various types of separations from pilot training. It has also been established that the BVDT score significantly augmented the multiple correlation of existing aviation selection variables with the same criteria. The purpose of this study was to determine if reliability, validity, and augmentation of correlation could be obtained with less disturbance to the subject than that caused by the 15-rpm speed of rotation used thus far in the BVDT. Reduced disturbance and aftereffects are desired because the BVDT is now envisioned as becoming part of the entering flight physical, and procedures that might either impair performance on the other tests or require recovery periods must be held at a minimum. The BVDT procedure used here was identical to two previous studies except that a speed of 10-rpm was used instead of 15-rpm. Subjects were 157 flight students who were tested within the first four days of reporting for training. It was concluded, that the 10-rpm BVDT was a feasible procedure. It was also concluded that, because the mean score for the 10-rpm group was lower than the mean for either of the two 15-rpm groups used previously, subject disturbance had been reduced. Author (GRA)

N71-21683# Kansas State Univ., Manhattan. Water Resources Research Inst.

WATER UTILIZATION ASPECTS OF WEATHER MODIFICATION AS APPLIED TO KANSAS Completion Report, 1 Jul. 1968-1 May 1970

Robert L. Smith Nov. 1970 72 p refs Prepared in cooperation with Kansas Univ., Lawrence *Its* Contrib No. 46

(Contract Di-14-01-0001-1635)

(PB-196310; OWRR-A-023-KAN-1) Avail: NTIS CSCL 08H

A digital model of the land phase of the hydrologic cycle is utilized to determine the probable response of Kansas streams to various patterns of rainfall augmentation. Seven test basins, representing a broad range of climatic conditions, are analyzed. Comparative analysis of the results of simulations performed for historic and augmented patterns indicates runoff response would be most sensitive to changes in the precipitation pattern. In Kansas, the percentage increase in average streamflow will be approximately four times the percentage increase in average precipitation-assuming uniform augmentation of the historic pattern. Justification for a statewide program of precipitation augmentation in Kansas would have to be highly dependent on benefits to dry land agriculture. An empirical relationship for determining the percentage gain in average runoff to be realized under conditions of uniformly augmented precipitation is presented. GRA

N71-21684# Bureau of Radiological Health, Rockville, Md. Office of Regional Operations.

THE SECOND ANNUAL NATIONAL CONFERENCE ON RADIATION CONTROL: THE QUEST FOR QUALITY

Oct. 1970 371 p refs Conf. held at Palm Beach, Fla., 26 – 29 Apr. 1970
(PB-196444; BRH/ORO-70-5) Avail: NTIS HC $6.00/MF $0.95 CSCL 06R

The conference concentrated on three major problem areas in radiological health: (1) public exposure to X radiation, (2) improving the qualifications of radiation users, and (3) environmental radiation around nuclear facilities. In addition to formal presentations by state, local and federal representatives, Committees of the Conference of Radiation Control Program Directors met and reported on specific radiation control programs. Author (GRA)

N71-21710# Atomic Energy Commission, New York. Health and Safety Lab.
FALLOUT PROGRAM Quarterly Summary Report, 1 Jun. – 1 Sep. 1970
Edward P. Hardy, Jr. 1 Oct. 1970 117 p refs
(HASL-237) Avail: NTIS

The results of the Health and Safety Laboratory (HASL) fallout investigation project are reported. Subjects discussed are: (1) strontium(90) accumulation in Colorado, (2) strontium(90) deposition in Atlantic Ocean, (3) observed concentrations of nuclides in the stratosphere compared with predictions by the streak model, (4) fallout monitoring in Italy, and (5) cesium and potassium concentrations in bulk food samples in Chicago, Illinois. Author

N71-21713# Joint Publications Research Service, Washington, D.C.
SOME HYDRODYNAMIC ASPECTS OF THE MOVEMENT OF CILIARY INFUSORIA
L. N. Seravin 10 1971 8 p refs Transl. into ENGLISH from Vestn. Leningr. Univ., Ser. Biol. (Leningrad), no. 21, Ser. no. 4, 1970 p 41 – 47
(JPRS-52581) Avail: NTIS

The manner in which ciliary infusoria are propelled in a hydraulic medium is discussed. The following conclusions are presented: (1) the movement of ciliary infusoria is possible due to a system of vortical currents of liquids which are produced by the ciliary system, (2) the movement and rotation of the ciliary infusoria depends little on the body shape, (3) the infusoria change direction by regulating the direction of rotation and movement of overall flow of the liquid, and (4) the shape and character of the infusoria motions are affected by retarding or heightening the work of various parts of the ciliary cover. Author

N71-21725# Joint Publications Research Service, Washington, D.C.
FREQUENCY SPECTRUM OF SPEECH AS AN INDICATOR OF THE DEGREE AND NATURE OF EMOTIONAL STRESS
V. A. Popov et al 23 Mar. 1971 8 p refs Transl. into ENGLISH from Zh. Vysshei Nervnoi Deyatel'nosti (Moscow), no. 1, 1971 p 104 – 109
(JPRS-52698) Avail: NTIS

Tie possibility of using the formant frequency of speech signals to evaluate the degree of emotional stress in human subjects is presented. The frequency regions of the peaks observed on the spectral picture of speech sounds are called formant zones or simply formants. The location of the spectral peaks corresponds more or less to the resonances of the speech tract. One of the principal characteristics of the spectrum of speech sounds is the number of formants and their distribution in the frequency region. During emotional stress, the formants are displaced or deformed thus producing an indication of the emotional intensity. Author

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N71-20603# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
PROCESSING OF VISUAL IMAGERY BY AN ADAPTIVE MODEL OF THE VISUAL SYSTEM: ITS PERFORMANCE AND ITS SIGNIFICANCE Final Report, Jun. 1969 – Mar. 1970
Oliver H. Tallman, II Nov. 1970 51 p refs
(AD-717157; AMRL-TR-70-45) Avail: NTIS CSCL 6/4

From a review of biological evidence and assumptions in the human visual system, a model is derived for the recognition of visual patterns. The abstraction of information under a smearing transformation by adaptive spatial filtering suggests a useful redefinition of the classical pattern recognition approach involving the extraction of distinct features or properties on a feature space. The digital simulation of the model for pattern recognition is described, and the performance of the model on a variety of tasks is reported. The scope of this simulation is thought to exceed that for any single pattern recognition model reported elsewhere. The significance of the performance of the model to several Air Force problems is discussed, and recommendations for continued investigations are suggested. Author (GRA)

N71-20604# Melpar, Inc., Falls Church, Va.
UNIVERSAL AIRCRAFT FLIGHT SIMULATOR/TRAINER SYSTEM DEFINITION Final Technical Report, Oct. 1969 – Sep. 1970
John E. Conant et al Sep. 1970 265 p refs
(Contract F33657-70-C-0451)
(AD-717179; Rept-9248-FR; ASD-TR-70-28) Avail: NTIS CSCL 5/9

In the definition study of the Universal Aircraft Flight Simulator/Trainer (UAFS/T), the total performance requirement and general configuration thereof are identified and described. The personnel, training, and facilities required to support, maintain, and house the UAFS/T are identified and described. The requirements for documentation in support of maintenance and operation of the UAFS/T are identified and described. Through an extensive review of the literature, a study is made of the physiology of the human vestibular and visual systems and quantitative values are determined for the desirable cockpit motion system, visual display system, and simulated instrument performance characteristics. Test reports on actual aircraft performance and an analysis of the expected advancement in these aircraft performances in the next 10 years are studied and quantitative values are determined for the desirable cockpit motion system, visual display system, and simulated instrument performance characteristics. These desirable performance characteristics are evaluated against present-day state-of-the-art mathematical modeling, digital computation systems, cockpit motion system concepts, and visual image generation and display techniques to determine and completely describe the recommended Performance Specifications for the UAFS/T. Author (GRA)

N71-20629# Naval Research Lab., Washington, D.C.
STABILITY OF THE MOLECULAR SIEVE STRUCTURE IN HOSTILE ENVIRONMENTS Final Report
E. T. Johnson, D. D. Williams, and R. R. Miller 7 Dec. 1970 12 p refs
(AD-716748; NRL-7201) Avail: NTIS CSCL 6/11

Proposals for the use of molecular sieves as regenerable CO_2 and/or H_2O absorbers in closed spaces have usually been based on their demonstrated efficiencies in pure atmospheres. The previously unknown effect of thermal cycling in more hostile environments containing a nominally stable halogenated hydrocarbon has been investigated. While the test halocarbon (dichlorodifluoromethane) was not itself deleterious, the acid products resulting from the molecular sieve-promoted decomposition of the compound caused structural damage to the sieves, which severely affected their capacities for CO_2 and H_2O. Sieves of the 5A and 10A type were investigated under a variety of conditions, with the 5A sieve being the more resistant to damage. Author (GRA)

N71-20683# Central Inst. for Industrial Research, Blindern (Norway).

TELEMETRIC MEASURING TECHNIQUES IN BIOMEDICAL RESEARCH [TELEMETRISK MAELETEKNIKK FOR BLA. BIOMEDISINSK FORSKNING]

Jul. 1969 39 p refs In NORWEGIAN; ENGLISH summary
(SI-Publ-619) Avail: NTIS

A brief survey of modulation and signal treatment, the main principles for telemetric measuring equipment for use in the biomedical field, and the available equipment is made. Author (ESRO)

N71-20698*# AiResearch Mfg. Co., Los Angeles, Calif.

STUDY OF MAN PULLING A CART ON THE MOON

A. Camacho, W. Robertson, and A. Walther Washington NASA Mar. 1971 124 p refs
(Contract NAS1-7053)
(NASA-CR-1697) Avail: NTIS CSCL 05H

The results are presented of a study made to evaluate the metabolic cost of self-locomotion in simulated lunar gravity using an EX-IA suit. The use of a cart as a load-carrying device was also evaluated. The tests were performed in a simulator using a blow-by piston suspension system. The effects of surface grades, surface characteristics, backpack weights, and cart weights on metabolic cost for various locomotive rates were determined. The range of surface characteristics investigated had only a small effect on the metabolic costs of locomotion. Pulling a cart weighing 165 pounds, earth weight, on a level surface did not increase the energy cost of locomotion over that obtained without the cart. Author

N71-20699# Southampton Univ. (England). Inst. of Sound and Vibration Research.

STARTLE DUE TO SONIC BOOM: STATEMENT OF THE PROBLEM

C. G. Rice and D. N. May Oct. 1969 45 p refs
(ISVR-TR-25) Avail: NTIS

This survey investigates the possibility that the sonic boom causes startle, inducing involuntary muscle contraction which combined with its mental impact precipitates accidents, disturbs sleep, impairs work performance, and damages health. The subject appears to be little researched; and it is suggested that if the real life effects of the boom are to be better understood, more work is needed in all these areas, particularly with regard to threshold effects and properties of the boom that cause startle, and to particular subgroups of the community whose reactions indicate disturbance. Author (ESRO)

N71-20718* Weber Aircraft Corp., Burbank, Calif.

DEVICE FOR SEPARATING OCCUPANT FROM AN EJECTION SEAT Patent

Earl W. Mussett, inventor (to NASA) Issued 5 Dec. 1967 (Filed 6 Jan. 1966) 8 p Cl. 244-122 Sponsored by NASA
(NASA-Case-XMS-04625; US-Patent-3,356,320; US-Patent-Appl-SN-519161) Avail: US Patent Office CSCL 06G

Upon ejection from the vehicle, a lanyard attached to the vehicle releases a firing pin spring whereby the firing pin ignites an explosive charge which drives a piston and associated mechanical linkage to release tie-down devices which secure the occupant to the seat. Gases from the charge subsequently ignite a second explosive charge which drives the piston of a thruster device attached to one end of an ejection strap which lies between the occupant and the seat. The strap is snapped taut by the thruster action and forcibly separates the occupant from the seat structure. Official Gazette of the U.S. Patent Office

N71-20735# Stanford Univ., Calif. Electronics Labs.

SYNEURISTOR: A DEVICE AND CONCEPT

Manjula Bhushan Waldron Jan. 1971 118 p refs
(Contract N00014-67-A-0112-0044)
(AD-716821; SU-SEL-70-062; TR-6560-22) Avail: NTIS CSCL 6/4

The report develops a new kind of device called a syneuristor (after synaptic neuristor). A syneuristor is defined by six properties. These properties are shown to be sufficient to build complex automata. A circuit is proposed which is capable of realizing the properties of a syneuristor. In developing the electronic circuits, the possibility of integrating them is kept in mind. An electronic syneuristor is shown to find immediate use in all electronic robots, while realization through ionic propagation appears to hold a great potential in using them in biological systems. A brief introduction brings together the existing knowledge in this direction along with the motivation which led the author to propose a syneuristor. A comprehensive treatment is given to the application of the syneuristor in system synthesis. In particular, the syneuristor is shown to be able to model biological synapse and therefore can find use in modelling some biological systems. The syneuristor can generate a complete logic system of its own. Author (GRA)

N71-20797# Army Aviation Systems Command, St. Louis, Mo. Flight Standards and Qualification Directorate.

HUMAN FACTORS ENGINEERING MOCK-UP FACILITY

Charles E. Righter May 1970 25 p refs
(AD-717026; FS/Q-TR-70-4; USAA VCOM-TR-70-12) Avail: NTIS CSCL 5/5

The report is a brief study of the value of a mock-up facility as a management tool. Included is a general discussion for the need of this facility along with area and space requirements, skills and number of personnel required and a budgeting estimate. Also included is a proposed schedule for installation and completion of all areas. Author (GRA)

N71-20799# Southampton Univ. (England). Inst. of Sound and Vibration Research.

STARTLE DUE TO PISTOL SHOTS: EFFECTS ON CONTROL PRECISION PERFORMANCE

D. N. May and C. G. Rice Oct. 1969 70 p refs
(ISVR-TR-26) Avail: NTIS

The effect on control precision performance of startle due to 16 pistol shots of 124 dB peak level was investigated in the laboratory using 14 students and secretaries aged from 20 to 29. It was found that performance was significantly impaired in the two seconds following each bang and not thereafter, but that a lessening of reaction occurred and was reported over the length of the experiment. Some evidence was found for the existence of a critical interval between presentations which was thought to mark the longest period for which subjects in a given situation maintain their expectancy. Evidence was also found that subjects who learn slowly attain low levels of proficiency that are less affected by bangs than the higher levels of proficiency of subjects who learn quickly. Author (ESRO)

N71-20951*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

PRELIMINARY RESULTS FROM AN OPERATIONAL 90-DAY MANNED TEST OF A REGENERATIVE LIFE SUPPORT SYSTEM

Albin O. Pearson and David C. Grana, comps. Washington 1971 579 p refs A symp. held in Hampton, Va., 17–18 Nov. 1970
(NASA-SP-261) Avail: NTIS HC$6.00/MF$0.95 CSCL 06K

Various study results from a 90-day manned test of a regenerative life support system in a space station simulator are reported. Operational performances of the integrated food-, water-, waste-, and atmospheric subsystems are emphasized and medical and psychological support criteria are described. For individual titles see: N71-20952 through N71-20999.

N71-20952*# National Aeronautics and Space Administration, Washington, D.C.

RATIONALE FOR INTEGRATED LIFE SUPPORT SYSTEMS

Walton L. Jones *In its* Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 1–3 (See N71-20951 10-05)

Avail: NTIS HC$6.00/MF$0.95 CSCL 06K

The status of life support research in space simulations is outlined and the application of results from a successful 90-day manned test of a regenerative life support system to space support missions in the 1980 to 1985 time period is projected. The need for automatic control, modular configuration, and the usefulness of larger crews and longer ground simulation tests is pointed out. G.G.

N71-20953*# McDonnell Douglas Astronautics Co., Huntington Beach, Calif.

TEST OBJECTIVES AND PROGRAM MANAGEMENT

J. K. Jackson *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 5–15 refs (See N71-20951 10-05)

Avail: NTIS HC$6.00/MF$0.95 CSCL 06K

Objectives of the 90-day operational manned test involved the evaluation of an advanced regenerative life support system similar to that of an orbiting scientific laboratory under closed door conditions. These objectives included determinations of long term operating characteristics and power requirements of individual sybsystems and the total system; measurements of mass and thermal balances; determination of the ability of the test crew to operate, maintain, and repair onboard equipment; measurements of chemical and microbial equilibria of the closed ecological system; assessment of the effect of confinement on the psychological and physiological characteristics of the test crew; and collection of data to assist in determining the precise role of man in performing in-flight experiments. Author

N71-20954*# McDonnell Douglas Astronautics Co., Huntington Beach, Calif.

FACILITY SUPPORT SYSTEMS

J. P. Valinsky, R. L. Malin, and N. R. Radke *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 17–33 ref (See N71-20951 10-05)

Avail: NTIS HC$6.00/MF$0.95 CSCL 06K

The facility for a 90-day manned test of a regenerative life support system is described including the support systems which were assembled to satisfy the program objectives and the safety requirements. Specific systems and equipment that are included are: the Space Station Simulator (SSS) chamber, the heating and cooling heat transfer loops, the electrical power system, the vacuum and freeze trap systems, the gas analysis system, the communications system, and the data system. The supporting laboratories which included microbiological, water analysis, and medical, are described and their effectiveness is discussed. Author

N71-20955*# McDonnell Douglas Astronautics Co., Huntington Beach, Calif.

LIFE SUPPORT SYSTEMS

J. K. Jackson *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 35–41 (See N71-20951 10-05)

Avail: NTIS HC$6.00/MF$0.95 CSCL 06K

The interior of the space station simulator was redesigned to provide an equipment room and a crew living area separated by an acoustic barrier. The life support equipment, operating instrumentation, and controls were located in the equipment room. Extensive provisions were made for acoustical control. The life support equipment included advanced units which were being operated for the first time in a manned test and baseline equipment which was available from the previously completed 60-day test. Integration of these units in such a manner that failure of a single unit did not jeopardize other test objectives was a major task of the systems engineers. The life support system included units for water management, thermal and humidity control, atmosphere purification, atmosphere supply and pressure control, waste management, and food management. Author

N71-20956*# McDonnell Douglas Astronautics Co., Huntington Beach, Calif.

WATER MANAGEMENT

D. F. Putnam, E. C. Thomas, and G. V. Colombo *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 43–90 ref (See N71-20951 10-05)

Avail: NTIS HC$6.00/MF$0.95 CSCL 06K

Water management subsystems used in the 90-day test were: (1) isotope heated VD-VF unit; (2) wick evaporator and humidity control unit; (3) detoxification-multifiltration unit; (4) potable water storage and distribution system; (5) backup potable water supply; and (6) wash water recovery unit. The performance data include mass and energy balances, water chemistry, and microbiological profiles. Pretest qualification procedures are covered as well as operating procedures used during the manned test. Author

N71-20957*# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

DESIGN AND DEVELOPMENT OF THE VACUUM DISTILLATION, VAPOR FILTERED, ISOTOPIC FUELED WATER RECOVERY SYSTEM FOR THE 90-DAY MANNED SIMULATOR TEST

Courtney A. Metzger *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 91–97 refs (See N71-20951 10-05)

Avail: NTIS HC$6.00/MF$0.95 CSCL 06K

The water recovery system for the 90-day manned simulator test is designed to recover potable water from pretreated urine and humidity condensate. This system uses radioisotopes for thermal energy and is based on vacuum distillation, vapor filtration, and catalytic oxidation of the contaminants in the vapor. The design and development of the system are described. Author

N71-20958*# McDonnell Douglas Astronautics Co., Huntington Beach, Calif.

PERFORMANCE EVALUATION OF THE THERMAL CONDITIONING UNIT

G. E. Allen *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 99–106 ref (See N71-20951 10-05)

Avail: NTIS HC$6.00/MF$0.95 CSCL 06K

The configuration and performance of a thermal conditioning unit used during the 90-day manned test is presented. High reliability was realized throughout the 90 days and no failures required maintenance. Areas of improvement in the basic design concepts have been indicated, based on experience gained during the test, which would improve the operation and efficiency of the thermal conditioning unit. Recommendations are offered which will considerably lower the power required, the quantity of primary atmosphere circulated, and the associated noise level of the unit in addition to providing individual compartment temperature control. Author

N71-20959*# McDonnell Douglas Astronautics Co., Huntington Beach, Calif.

PERFORMANCE OF THE CO_2 CONCENTRATORS

E. S. Mills and T. J. Linzey *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 107-115 (See N71-20951 10-05)
Avail: NTIS HC$6.00/MF$0.95 CSCL 06K

The CO2 concentrator system consisting of the advanced baseline solid amine system, the backup molecular sieve system, and the emergency lithium hydroxide-Gemini CO2 removal unit performed satisfactory. The average CO2 concentration in the cabin over the 90-day test time averaged approximately 5 mm Hg rather than the intended 4 mm Hg, primarily because of the problems with adjusting the solid amine concentrator. The solid amine unit was used for CO2 control during the majority of the first 81 days of the test. When adjusted correctly, with the proper water balance in the beds, the unit maintained the CO2 cabin concentration at the specified level. The performance of the molecular sieve CO2 concentrator was satisfactory, serving the role of backup when needed. Author

N71-20960*# McDonnell Douglas Astronautics Co., Huntington Beach, Calif.
OPERATIONAL CHARACTERISTICS OF THE INTEGRATED SABATIER/TOXIN BURNER UNIT
J. F. Harkee *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 117-129 ref (See N71-20951 10-05)
Avail: NTIS HC$6.00/MF$0.95 CSCL 06K

Operation of the Sabatier reactor during the initial 30 days of the 90-day manned test was somewhat complicated by catalyst poisoning caused by trace quantities of Freon-113 (TF) appearing in the carbon dioxide. Operation returned to normal after replacing the catalyst and adding a charcoal trap to remove the contaminant from the carbon dioxide. The Sabatier unit produced about 350 lb of water during the test. The average water production rate for the last 60 days was 4.38 lb/day. The reactor converted over 95 percent of the hydrogen processed to water. The toxin burner operated normally throughout the test. Author

N71-20961*# Hamilton Standard, Windsor Locks, Conn.
PERFORMANCE OF A SOLID-AMINE CARBON DIOXIDE CONCENTRATOR DURING A 90-DAY MANNED TEST
Harlan F. Brose and Rex B. Martin (NASA. Langley Res. Center) *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 131-143 refs (See N71-20951 10-05)
Avail: NTIS HC$6.00/MF$0.95 CSCL 06K

A carbon dioxide concentration system which utilized a regenerable amine absorbent was used in the 90-day manned test. The system design provided for limited automatic operation with manned override capability. The successful operation of the unit during the 90-day test establishes solid amine as a feasible CO2 absorbent with certain advantages over a molecular sieve CO2 control system. The principal advantages demonstrated in the 90-day test are the ability of the sorbent material to operate with humid influent gas, with good performance at low CO2 pressures, and with the ability to desorb CO2 at ambient pressure and higher. Author

N71-20962*# McDonnell Douglas Astronautics Co., Huntington Beach, Calif.
ANALYSIS OF TRACE CONTAMINANTS
P. P. Mader and J. K. Jackson *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 145-158 (See N71-20951 10-05)
Avail: NTIS HC$6.00/MF$0.95 CSCL 06K

During the 90-day operation of the Space Station Simulator (SSS) and the short duration manned and unmanned test runs which preceded it, analytical support was provided by determining the composition and daily fluctuations of trace contaminants. Analysis of atmospheric samples for the presence of trace contaminants was done by chromatograph on direct samples and concentrated samples obtained by freeze-out techniques to determine the presence of organic compounds. The direct samples indicated the presence of as many as nine organic contaminants although none were present at levels approaching critical values. Inorganic compounds were measured by wet chemical analyses on daily samples; compounds detected included total aldehydes and ammonia during some periods. Tests run on CO2 removed from the cabin by the molecular sieve and solid amine units indicated increased concentration of Freon TF. Tests on catalyst from the Sabatier reactor and a white powder found at the outlet of the toxin burner indicated heavy concentrations of halogens. Author

N71-20963*# Aerojet Electrosystems Co., Azusa, Calif. Analytical Research Labs.
MEASUREMENT OF TRACE ATMOSPHERIC CONSTITUENTS IN THE 90-DAY SPACE STATION SIMULATOR
M. L. Moberg and C. L. Deuel *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 159-177 (See N71-20951 10-05)
Avail: NTIS HC$6.00/MF$0.95 CSCL 06K

Analytical data and methods of collecting trace atmospheric components found during the 90-day manned space chamber test are reviewed. The three collection methods and special sampler used on this program provided samples for measuring the major, minor, and trace components with classical gas volumetric analytical precision throughout the dynamic range and with reasonable turnaround time. Approximately 100 components were identified and quantitatively measured using gas chromatography, mass spectrometry, infrared spectrophotometry, and high-vacuum rack manipulation. With relatively few exceptions the Space Station Simulator atmosphere was found to be of higher quality than the average troposphere. Author

N71-20964*# Transportation Systems Center, Cambridge, Mass.
RESULTS OF THE AEROSOL ANALYSIS EXPERIMENT PERFORMED DURING A 90-DAY MANNED TEST OF AN ADVANCED REGENERATIVE LIFE SUPPORT SYSTEM
Walter F. Harriott and Robert A. Walter *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 179-187 Supported in part by OART and by NASA (See N71-20951 10-05)
Avail: NTIS HC$6.00/MF$0.95 CSCL 06K

Preliminary results from the aerosol analysis experiment are presented. The membrane filter data indicate the trend of particulate concentration in the simulator. The filters have also been partially analyzed by scanning electron microscopy for particle type. Close correlation in particle production has been found between submicrometer and micrometer particles and the particle producing activities within the simulator. Author

N71-20965*# McDonnell Douglas Astronautics Co., Huntington Beach, Calif.
WATER ELECTROLYSIS SYSTEMS
E. S. Mills *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 189-202 refs (See N71-20951 10-05)
Avail: NTIS HC$6.00/MF$0.95 CSCL 06K

Three different water electrolysis units were used during the 90-day test of a regenerative life support system. A commercial unit was used for backup to two experimental units. One experimental unit uses a vapor feed and intermittent circulation of electrolyte

and was installed inside the space station simulator. The other unit uses a liquid feed with continuous electrolyte circulation and was installed outside the chamber. All three units operated with some degree of success during the test period. The experimental units provided 71.6 percent of the total hydrogen required and 68.3 percent of the total oxygen required. All units experienced failures. Some of these failures caused early shutdowns due to inaccessibility and lack of proper parts; other failures were repairable because the unit was outside the chamber. Author

N71-20966*# McDonnell Douglas Astronautics Co., Huntington Beach, Calif.

OPERATIONAL CHARACTERISTICS OF A TWO GAS CONTROLLER

J. F. Harkee *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 203-208 ref (See N71-20951 10-05)

Avail: NTIS HC$6.00/MF$0.95 CSCL 06K

A system for controlling and metering the supply of atmospheric gases to the space station simulator during the recent 90-day manned test functioned successfully. A four-gas mass spectrometer was utilized to generate the control signals to the atmospheric controller. The controller added 862 lb of oxygen and 279 lb of nitrogen to the space station simulator during the test. During most of the test, the oxygen partial pressure was controlled within + or - 0.5 mm Hg of the control setpoint and the nitrogen partial pressure within + or - 8 mm Hg. The reduced accuracy of the nitrogen channel was apparently due to the higher than predicted cabin leakage associated with a low control loop gain, and can be improved by simple design modifications. Author

N71-20967*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

LOCKHEED ELECTROLYSIS SYSTEM FOR THE 90-DAY MANNED TEST

Thomas M. Olcott and Barbara M. Greenough *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 209-219 (See N71-20951 10-05)

Avail: NTIS HC$6.00/MF$0.95 CSCL 06K

The electrolysis system for the ninety day test was designed as a back-up system to operate either inside or outside the space station simulator. The system provides oxygen automatically on demand at a design rate of 8.0 lb/day. Startup and shutdown of the system can be accomplished quite rapidly and are manual operations except for the automatic safety shutdown. Safety status indicators are provided on the front panel for performance monitoring. Author

N71-20968*# Perkin-Elmer Corp., Pomona, Calif. Aerospace Systems Div.

EVALUATION OF A FOUR-GAS MASS SPECTROMETER USED FOR ATMOSPHERIC CONTROL DURING THE 90-DAY TEST

Michael R. Ruecker *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 221-244 (See N71-20951 10-05)

Avail: NTIS HC$6.00/MF$0.95 CSCL 06K

The design and performance of a mass spectrometer atmospheric sensor system which was utilized for monitoring and control of the atmosphere of a manned space station simulator during a 90 day test is reviewed. The instrument operated with a new closed loop electronics control system for improved long term stability. Based upon calibration verification data taken during the 5-day and 90-day runs, the instrument was demonstrated to hold its calibration within 1% for nitrogen, 2% for oxygen, and 3% for carbon dioxide for a period of 132 days. It also monitored water vapor partial pressure. The output signal from the oxygen channel was employed by an atmosphere control system for maintaining the oxygen partial pressure of the space station simulator. The instrument demonstrated its ability to perform reliably. Author

N71-20969*# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

DESIGN AND OPERATION OF A WASTE MANAGEMENT SYSTEM FOR FECAL COLLECTION AND SAMPLING DURING THE 90-DAY MANNED SIMULATOR TEST

Courtney A. Metzger *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 245-250 refs (See N71-20952 10-05)

Avail: NTIS HC$6.00/MF$0.95 CSCL 06K

A component designed for the collection, processing, and storage of feces and toilet tissue aboard aerospace vehicles has been fabricated and successfully tested. This system extends the useful life of a prior design by use of a replaceable liner assembly (liner, slinger, motor, and filter), sized for approximately 200 man-days accumulation. The filter prevents contamination of all downstream lines and permits changing of the liner without contamination of the cabin. Other features of the unit are a quick acting slide-valve assembly, a fecal sampler, and a disinfectant dispenser. Author

N71-20970*# McDonnell Douglas Astronautics Co., Huntington Beach, Calif.

WASTE MANAGEMENT SUBSYSTEM

J. K. Jackson and R. E. Shook *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 251-258 (See N71-20951 10-05)

Avail: NTIS HC$6.00/MF$0.95 CSCL 06K

The waste management subsystem included the commode, urine collector, and urine phase separator. The urine collector was an Apollo type with built-in flush water injector. The urine phase separator included automatic pretreatment injection. Operation and crew acceptance of all units were generally adequate except the urine phase separator, in which the polyurethane impeller was dissolved early in the test by an accidental injection of concentrated pretreatment solution. Subsequent use of the urine collection system required the use of gravitational forces for phase separation. The commode required liner replacement once during the mission, on day 44, and was used 319 times. Author

N71-20971*# McDonnell Douglas Astronautics Co., Huntington Beach, Calif.

FOOD MANAGEMENT PROGRAM

J. S. Seeman and D. J. Myers *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 259-267 (See N71-20951 10-05)

Avail: NTIS HC$6.00/MF$0.95 CSCL 06K

The food provisions available to onboard crewmen during the 90-day test consisted of a primary freeze dried menu, supplementary snacks, frozen dinners, glycerol (sweetener), and a small amount of ice cream. Packaging, storage accommodations, supporting equipment, and acceptability for the food supplies are discussed. Recommendations for food programs for future long-term space missions are provided. Author

N71-20972*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

USE OF GLYCEROL AS A DIET SUPPLEMENT DURING A 90-DAY MANNED TEST

Jacob Shapira *In its* Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 269–275 refs (See N71-20951 10-05)
Avail: NTIS HC$6.00/MF$0.95 CSCL 06K

The crewmen during a ninety day manned test ingested a glycerol solution mixed with various other food materials during two different five day periods. The glycerol diet supplement was judged to be better than average and did not lead to an elevation in serum free glycerol. An erratic and inconsistent rise in urine-free glycerol, as determined by an enzymatic method, was observed. As expected, there was no nausea or ill effect observed during the use of free glycerol as a food adjunct. Author

N71-20973*# McDonnell Douglas Astronautics Co., Huntington Beach, Calif.
MASS BALANCE DATA
J. K. Jackson, L. G. Barr, and J. F. Harkee *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 277–291 (See N71-20951 10-05)
Avail: NTIS HC$6.00/MF$0.95 CSCL 06K

The overall mass balance data discussion for the 90-day test includes consideration of the potable water recovery, the wash water recovery, the atmosphere supply, and the atmosphere recovery units. From these data and other records, the crew input/output requirements are determined. Each of these areas is discussed in detail. Author

N71-20974*# McDonnell Douglas Astronautics Co., Huntington Beach, Calif.
THERMAL BALANCE DATA
J. K. Jackson and G. E. Allen *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 293–300 (See N71-20951 10-05)
Avail: NTIS HC$6.00/MF$0.95 CSCL 06K

Thermal conditioning of the Space Station Simulator (SSS) during the 90-day test was done by a cooling loop circulating Coolanol 35 at 32 to 40 F. Process heating fluid was also provided by a circulating loop using electrically heated Coolanol 35. This loop supplied the carbon dioxide concentrators: the solid amine unit at about 240 F and the molecular sieve unit at 320 F. Total heat removed from the chamber varied from 22,846 Btu/hr (6.695 kW) to 29,514 Btu/hr (8.650 kW), depending on operating mode of the life support units. This total does not include thermal control requirements for water electrolysis, because operating time on the unit was too short to reach equilibrium. Author

N71-20977*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEVELOPMENT OF CREW SELECTION GUIDELINES FOR THE 90-DAY MANNED TEST
Rayford T. Saucer *In its* Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 323–327 refs (See N71-20951 10-05)
Avail: NTIS HC$6.00/MF$0.95 CSCL 05I

A panel or steering committee of behavioral scientists was created to advise operations personnel on selection methods for the crew. The panel, acting in an advisory capacity, made recommendations concerning crew selection, monitoring, and assessment. A generalized concept of crew selection for long duration missions was developed on the basis of motivation, skill levels, emotional maturity, and observations of group compatibility. Author

N71-20978*# McDonnell Douglas Astronautics Co., Huntington Beach, Calif.
CREW SELECTION
J. S. Seeman and M. V. McLean *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 329–337 (See N71-20951 10-05)
Avail: NTIS HC$6.00/MF$0.95 CSCL 05I

The successful selection of crewmen for the 90-day manned test was a major contribution to the total study. A highly selected group of individuals was screened and evaluated for compliance with numerous criteria relating to their acceptability and ability to withstand isolation stresses. Results of the crew selection process indicate that crew selection was an important contributor to the overall success of the 90-day test. In addition, quantitative psychological criteria have been developed which can be employed on future studies of this nature. Certain limitations in the use of psychological testing techniques have been identified and the importance of pragmatic aspects of personnel selection has been demonstrated. Author

N71-20979*# McDonnell Douglas Astronautics Co., Huntington Beach, Calif.
CREW TRAINING
R. E. Shook and J. S. Seeman *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 339–362 (See N71-20951 10-05)
Avail: NTIS HC$6.00/MF$0.95 CSCL 05I

The purpose of the crew training program was to prepare candidates for effective participation in the 90-day manned test. Curriculum coverage was accomplished over an approximate 6-month period and consisted of training in experiment operations, safety procedures, equipment operating procedures, and maintenance and data collection requirements. The training program contributed significantly to the success of the 90-day manned test insofar as it provided a well trained, highly motivated crew for integration with the operations required onboard the space station simulator. Author

N71-20980*# McDonnell Douglas Astronautics Co., Huntington, Calif.
BEHAVIORAL PROGRAM
J. S. Seeman and M. V. McLean *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 363–375 (See N71-20951 10-05)
Avail: NTIS HC$6.00/MF$0.95 CSCL 06S

The behavioral program assessed effects of confinement on crew behavior in the areas of psychological status, sleep durations, and task performance. Psychological status and sleep durations were measured by objective questionnaires. Task performance information was obtained by TV monitoring of the onboard crew. Psychologically, the test was not severely stressful as expected, but periods of low morale and mild hostility were noted. Certain tests appear somewhat insensitive and are candidates for exclusion from future studies. More subtle or sensitive tests must be developed in their stead. Sleep durations were significantly shorter during the early part of mission for crewmen on inverted sleep cycle and adaptation did not occur until approximately the mid point in the test. Task performance information indicates a relatively poor use of the crew in terms of work performance. Author

N71-20981*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MANNED MISSION ACTIVITY ANALYSIS
Karen Brender and Edward R. Regis (McDonnell Douglas Astronaut. Co.) *In its* Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 377–391 (See N71-20951 10-05)
Avail: NTIS HC$6.00/MF$0.95 CSCL 05E

The objectives of the mission activity analysis experiment on the 90-day test were to generate manual and computer schedules of planned crew activities for the purposes of: (1) evaluating the planning and scheduling capabilities of the space station simulation mathematical model; and (2) comparing crew performance data with manual and computer generated crew activity schedules. The experiment objectives were successfully accomplished. Crew event descriptions and scheduling activities acted as forcing functions for early identification of problem areas and operational constraints. The crew activity schedule provided direct and material support to the successful operations conducted during the test. Author

N71-20982*# McDonnell Douglas Astronautics Co., Huntington Beach, Calif.
HABITABILITY
J. S. Seeman, R. V. Singer, and M. V. McLean *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 393-414 (See N71-20951 10-05)
Avail: NTIS HC$6.00/MF$0.95 CSCL 05E

An overview is provided of the more outstanding findings regarding crew reaction to the environment afforded within the space station simulator during the 90-day confinement. Such areas as lighting, clothing, acoustic environment, and responses to the onboard habitability inventory are discussed. An examination of crew responses indicates that the environment adequately supported the habitability needs of the four crewmen. In those instances where difficulties were apparent, recommendations are offered for design alteration in future missions. Author

N71-20983*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PSYCHOMOTOR PERFORMANCE DURING THE 90-DAY MANNED TEST
Rayford T. Saucer, Patrick A. Gainer, and Grady V. Maraman *In its* Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 415-419 refs (See N71-20951 10-05)
Avail: NTIS HC$6.00/MF$0.95 CSCL 05E

A psychomotor test device was placed aboard the 90-day test chamber. Subjects were tested four times daily. Data were analyzed for effects of confinement and for effects of selected trace gases. Long term effects were not found; however, short term relationships between the gas levels and the psychomotor performance were found to be small but significant. Author

N71-20984*# Systems Technology, Inc., Hawthorne, Calif.
CREW PERFORMANCE ON SIMULATED CONTROL TASKS
R. Wade Allen and Henry R. Jex *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 421-435 refs (See N71-20951 10-05)
Avail: NTIS HC$6.00/MF$0.95 CSCL 05E

In order to test various components of a regenerative life support system and to obtain data on the physiological and psychological effects of long duration exposure to confinement in a space station atmosphere, four men were sealed in the space station simulator for 90 Days. A tracking test battery was administered during the above experiment. The battery included a clinical test related to the subject's dynamic time delay and a conventional steady tracking task during which dynamic responses and performance measures were obtained. The subjects were extensively trained prior to confinement and generally reached asymptotic performance levels. Good correlations were noted between the clinical critical instability scores and more detailed tracking parameters such as dynamic time delay and gain-crossover frequency. The chamber environment caused no significant decrement on the average crewman's dynamic response behavior, and the subjects continued to improve slightly in their tracking skills during the 90-day confinement period. Author

N71-20985*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTS OF LONG DURATION CONFINEMENT ON SHORT-TERM MEMORY
R. Mark Patton and Clayton R. Coler *In its* Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 437-445 refs (See N71-20951 10-05)
Avail: NTIS HC$6.00/MF$0.95 CSCL 05J

A short-term memory test device, the Response Analysis Tester (RATER) was used in the 90-day study. Two test conditions, delay and no delay, were used. The no-delay condition required that the subject respond to the symbol currently being presented, and no short-term memory was involved. The delay condition required the subject to respond according to the symbol that had been presented two stimulus events prior in the sequence. Since all responses had to be delayed by two symbols, short-term memory was required throughout this test condition. Since most of the subjects continued to show performance improvement over a large number of test sessions, and since asymptotic performance was desirable prior to confinement, 28 training sessions were specified for the 90-day study. A stimulus presentation rate of one symbol per second was selected. A two-symbol delay seemed to provide the desired level of difficulty for the short-term memory testing. Author

N71-20986*# McDonnell Douglas Astronautics Co., Huntington Beach, Calif.
NON-INTERFERENCE PERFORMANCE ASSESSMENT (NIPA)
M. M. Okanes, W. R. Feeney, and J. S. Seeman *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 447-460 ref (See N71-20951 10-05)
Avail: NTIS HC$6.00/MF$0.95 CSCL 05E

One of the original goals of this program was to develop unobtrusive methods of obtaining social and emotional data from crewmen on the 90-day space station simulator test by visually and aurally observing behavior. The object was to avoid the resistance produced by intrusive measurement and its concomitant effect on the data being gathered. However, unobtrusive observation means that crewmen must be completely unaware of observations being made. This was not possible because of the policy of giving as much information as possible to the crewmen about all aspects of the program. Thus, this study is viewed as a test of methodology and not as a means for contributing substantively to theoretical constructs in individual or social psychology. Author

N71-20987*# California Univ., Los Angeles.
PSYCHOLOGICAL ASSESSMENT OF CONFINED CREWS
Barry E. Collins, Joan Ranere, and Alvan Rosenthal *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 461-469 refs (See N71-20951 10-05)
Avail: NTIS HC$6.00/MF$0.95 CSCL 05J

The physical locations of the crewmen, their physical movements, and the task and affective aspects of their written communications were observed in order to identify and forecast problems in crew performance during long term confinement. Data from the 90-day space station simulation test suggest that boredom correlated positively with task loads and quality of diary transcriptions; the crew was at its best when the task load was heaviest. Transcript quality indices increased on days when the crew took long trips around the simulator by 0.09 to 0.34. G.G.

N71-20988*# Douglas Aircraft Co., Inc., Huntington Beach, Calif.
BEHAVIORAL ACOUSTICS: THE IMPACT OF SPACE

SIMULATOR NOISE ON CREW MEMBERS

Lawrence E. Langdon, Richard F. Gabriel, and Paul A. Abell *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 471-478 refs (See N71-20951 10-05)

Avail: NTIS HC$6.00/MF$0.95 CSCL 05E

A multi-faceted program was used to evaluate the effects of space station simulator background noise on the crew members. The main goal was to define limits for the background noise in future long duration missions. A 1/2-hour behavioral acoustics test battery was given for each crew member weekly. Repeated habitability questionnaires, a post test questionnaire on noise, and a noise debriefing were used to obtain crew reactions. The living quarters noise, approximately 64 db(A) was rated reasonably satisfactory. The equipment area noise, approximately 77 db(A) was not well accepted, although crew members spent limited time in that area. Intermittent noises such as pumps and talking were rated as the worst noise problem, especially when trying to sleep. Specific recommendations based on these findings and assessment of the adequacy of the acoustics test program are provided. Author

N71-20989*# McDonnell Douglas Astronautics Co., Huntington Beach, Calif.

EEG MONITORING/SLEEP STUDIES

R. D. Joseph, W. B. Martin, and S. S. Viglione *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 479-494 refs (See N71-20951 10-05)

Avail: NTIS HC$6.00/MF$0.95 CSCL 05E

The 90-day test program provided for the acquisition and analysis of EEG and EOG recordings taken from 39 nights of sleep divided between two subjects. Approximately 350 hours of data were acquired and analyzed. An automatic scoring system was designed for each of the two subjects participating in the sleep studies. Six classifications are provided: awake, rapid eye movement (REM), and stages 1 through 4, as defined by the Association for the Psychophysiological Study of Sleep (APSS). In addition, movements and artifacts were also detected. Sleep behavior of the men deviated little during the 90-day run with some changes between days 60 and 70. In general, both crewmen had little slow wave activities, averaging 30 minutes per night for one man and 5 minutes per night for the other crewman. Author

N71-20999*# McDonnell Douglas Astronautics Co., Huntington Beach, Calif.

SUMMARY AND CONCLUSIONS

J. K. Jackson and Albin O. Pearson (NASA. Langley Res. Center) *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 599-603 (See N71-20951 10-05)

Avail: NTIS HC$6.00/MF$0.95 CSCL 06K

The 90-day manned test of a regenerative life support system has been completed with the accomplishment of the following seven major objectives: (1) the biological and chemical isolation of the space station simulator was maintained; (2) the regenerative life support systems operated effectively in producing potable water, removing atmospheric contaminants, and recovering oxygen from carbon dioxide; (3) provisioning of spares, tools, and expendables permitted mission completion; (4) data were obtained that defined system and subsystem mass and thermal balance and power requirements; (5) all maintenance and repair of the onboard equipment were conducted by the test crew; (6) data on planning and procedures and corresponding crew performance were obtained; and (7) data were obtained on physiological and psychological effects of confinement on the test crew. Author

N71-21207# Picatinny Arsenal, Dover, N.J.

A VISUAL DETECTION AND RECOGNITION THRESHOLD STUDY OF FOUR GEOMETRIC SHAPES

Jack Carlock, Jay C. Rayner, and Bruce L. Bucklin Dec. 1970 47 p

(AD-717004; PA-TM-1956) Avail: NTIS CSCL 6/16

A detection and identification test of four basic geometric shapes was conducted. The test was conducted in two phases. In phase 1 the stimulus objects were painted with an olive green flat latex paint (OG); in Phase 2, after having been so painted, they also were coated with a noncuring silicone-based adhesive. 200 enlisted personnel participated as subjects. The report presents the results of the test. Author (GRA)

N71-21229# International Business Machines Corp., Gaithersburg, Md. Federal Systems Div.

FUNCTION OF A MAN-MACHINE INTERACTIVE INFORMATION RETRIEVAL SYSTEM Annual Progress Report

John H. Williams, Jr. Oct. 1970 35 p refs

(Contract N00014-70-C-0297)

(AD-716954) Avail: NTIS CSCL 5/2

An effective man-machine interactive retrieval system is not achieved by simply placing a terminal on each end of an existing machine retrieval system. An interactive system requires a sequence of steps in which man and machine alternately take action. It should also provide different levels of services to experienced and inexperienced searches, recognize the difference between a narrow and broad query, furnish clues as to the next direction to be searched, reorganize the data base dynamically as the searcher changes his view-point, providing a ranking of responses in the most likely sequence and offer the searcher the option of overriding the ranking when a particular term is of extreme significance. An online interactive system meeting many of these needs was developed and tested. The objective of the development of this system, BROWSER, was to investigate the effectiveness of a free-form query with a combinatorial search algorithm and the effectiveness of various techniques and components to facilitate online browsing. Author (GRA)

N71-21486# Stanford Research Inst., Irvine, Calif. Southern California Labs.

FEASIBILITY INVESTIGATIONS OF ELECTROSTATIC PRECIPITATION FOR THE REMOVAL OF GASEOUS TRACE CONTAMINANTS FROM MANNED CABIN ATMOSPHERES Final Report, 1 Oct. 1968 - 15 April 1970

George J. Doyle, Robert Weaver, and Quentin McKenna Oct. 1970 38 p refs

(Contract F33165-69-C-1047)

(AD-716864; AMRL-TR-70-73) Avail: NTIS CSCL 6/11

The feasibility of electrostatic precipitation of clustered lithium ions for removal of gaseous trace contaminants from atmospheres could not be demonstrated under the constraints imposed on the experimental work. The major difficulty was that the thermionic source cause oxidation of the contaminants (acetone, methanol, and propane at 1-25 ppm concentration). The source was designed to minimize thermal effects such as oxidation and consume about the minimum practical heating power density to produce the necessary ion current in atmospheres near 760 torr pressures. Even at trace concentrations of oxygen in nitrogen, the oxidation rates were sufficient to obscure any possible precipitation effects. Author (GRA)

N71-21510*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SUMMARY OF TESTING FOR TRACE CONTAMINANTS IN THE BIOSATELLITE 3 SPACECRAFT ATMOSPHERE

Lou S. Young Oct. 1970 95 p refs

(NASA-TM-X-62004) Avail: NTIS CSCL 06A

Biosatellite 3 was the first U.S. spacecraft to maintain a normal earth atmosphere for its biological-specimen payload.

Preflight ground tests showed that the spacecraft atmosphere contained undesirable trace contaminants. Strict control was imposed over the introduction of nonmetallic materials and the use of solvents in and around the flight spacecraft cabin and its components. External ambient atmospheres were also controlled. A series of tests verified that the resulting atmosphere was safe for long-term occupancy by the experimental animal. The atmosphere of the recovered Biosatellite 3 contained higher levels of a few contaminants than were detected in the preflight tests, and the ammonia and aldehyde levels were especially high; but none of the contaminants are thought to have reached toxic concentrations. Author

N71-21641# Epoxylite Corp., South El Monte, Calif.
DEVELOPMENT OF SATISFACTORY LONG TERM PERCUTANEOUS LEADS Final Report, 9 Jun. 1967–24 Oct. 1969
Henry L. Lee, Jr., David E. Ocumpaugh, Arthur L. Cupples, and Gordon W. Culp Apr. 1970 346 p refs
(Contract PH-43-67-1108)
(PB-196985; RR-70-118) Avail: NTIS HC $6.00/MF $0.95 CSCL 06L

A percutaneous lead was developed which features a central percutaneous, cylindrical conduit with an exterior flange and a subcutaneous fenestrated skirt. The flange prevents overgrowth of the conduit, while the skirt provides immobilization when connective tissue invades the fenestration. Animal experiments, including 88 leads in 23 dogs, 16 leads in 6 monkeys, and 10 leads in 4 pigs, were performed using 12 different materials of construction and 28 variations of configuration. Satisfactory lead performance is characterized by absence of serious weeping despite induced trauma by the free-ranging animal, continuous exposure to ubiquitous vivarium organisms, and externally applied broths of virulent bacteria. Author (GRA)

N71-21649# Bell Aerosystems Co., Buffalo, N.Y.
RESEARCH ON THE CLASSIFICATION OF STATISTICALLY AND GRAPHICALLY DEFINED PATTERNS Final Report
Lester A. Gerhardt and Kenneth W. Drake 10 Dec. 1970 52 p refs
(Contract AF 49(638)-1627)
(AD-717219; BA-9500-920196; AFOSR-70-2929TR) Avail: NTIS CSCL 9/2

Improved target detection and classification capability is the aim of the report. Two types of target clues or features are considered, spectral and spatial. The emphasis is placed on using automatic means for performing the detection with the classification being performed by a human operator. For the spectral clues, a statistical model was used to aid in the classification of spectral signatures. For the near IR and video region, a six dimensional space was sufficient for most problems. Results are given for a set of actual data covering seven different classes. Approaching the detection problem as a separate entity, optimized preprocessing spectral filters are developed. Binary filters which are proven to also be optimum are derived and an algorithm for finding them is given. Author (GRA)

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N71-20684# Los Alamos Scientific Lab., N.Mex.
CONTROLLED POTENTIAL COULOMETRIC AND POTENTIOMETRIC TITRATIONS OF URANIUM AND PLUTONIUM IN CERAMIC TYPE MATERIALS
Glenn R. Waterbury, Gilbert B. Nelson, Karl S. Bergstresser, and Charles F. Metz Oct. 1970 19 p refs
(Contract W-7405-eng-36)
(LA-4537) Avail: NTIS

Accurate and precise measurements of the plutonium and uranium contents of mixed oxide, mixed carbide, and mixed nitride materials are now possible by methods developed for this purpose or by previously existing methods. Chemical separation of the elements before analysis is not necessary. Under optimum conditions for repeated analyses of (U sub x Pu sub y)O2, (U sub x Pu sub y)C, and solutions containing high-purity uranium and plutonium, the relative standard deviation and the bias range from 0.03 to 0.14%. For analysis of sintered uranium–plutonium nitrides, the relative standard deviations did not exceed 0.3%. The effects of certain impurities and techniques for eliminating carbonaceous decomposition products were investigated. Author (NSA)

N71-20685# Brookhaven National Lab., Upton, N.Y.
DETERMINATION OF SILVER, CADMIUM, INDIUM, TIN, AND ANTIMONY IN SODIUM SOLUBILITY STUDIES
S. J. Tassinari and C. Auerbach, comps. Jun. 1970 15 p refs
Sponsored by AEC
(BNL-50271) Avail: NTIS

Procedures are described for the determination of silver, cadmium, indium, tin, and antimony when present individually in combination with sodium. The work was performed in support of a study of dilute binary sodium alloys. The matrix is dissolved in ethanol; the solute metal is filtered off and determined by conventional methods. Titration of the NaOH resulting from the dissolution yields the total weight of sodium. Author (NSA)

N71-20686# Montecatini Edison S.p.A., Milan (Italy). Centro Ricerche Resine.
COMPOSITIVE CHARACTERIZATION OF COPPER-CLAD LAMINATES AND OF RESINS FOR ELECTRIC AND ELECTRONIC ASSEMBLIES
1 Apr. 1970 21 p
(Contract ESTEC-458/67/AA)
Avail: NTIS

Some samples of copper clad laminates used for printed circuits and some resins suitable for insulation, impregnation, and embedment of electric and electronic circuits are discussed. Author (ESRO)

N71-20694# Indiana Univ., Bloomington. Dept. of Chemistry.
QUANTUM CHEMISTRY PROGRAM EXCHANGE (QCPE) NEWSLETTER 30 Final Report
H. Shull Aug. 1970 72 p refs
(Grant AF-AFOSR-0767-67)
(AD-717162; AFOSR-70-2890TR) Avail: NTIS CSCL 7/4

The report provides a brief history of the Quantum Chemistry Program Exchange (QCPE) located at Indiana University, Bloomington, Indiana. In addition, procedures for submitting programs to QCPE, procedures for requesting programs for QCPE, and a description of available QCPE literature are presented. Author (GRA)

N71-20700# Dow Chemical Co., Golden, Colo.
EXPLOSIVE NATURE OF URANIUM-BASE NIOBIUM ALLOYS AFTER IMMERSION IN NITRIC ACID
Ross J. Jackson and Wilbur L. Johns 8 Dec. 1970 5 p refs
(Contract AT(29-1)-1106)
(RFP-1575) Avail: NTIS

The explosive behavior of uranium-base niobium alloys after immersion in nitric acid is characterized. The explosive behavior is related to a finely divided, two-phase microstructure, and to a high carbon content. In the first case, the nitric acid selectively attacks

the alpha-uranium phase leaving behind a explosive violence. In the second case, niobium carbide inclusions accumulate at the surface and are likewise subject to rapid oxidation. The most violent explosions occur with slow-cooled, slab-cast, high-carbon alloys having a casting scale of UO and UO2. Nitric acid dissolves the UO and UO2 casting scale and leaves behind a reactive surface layer of finely divided gamma-U, Nb2C, NbC, and UO2.(NO3)-6H2O. When this wet or dry layer is sparked or struck, a violent decomposition occurs which rapidly produces large quantities of gases and heat, and leaves behind a residue of UO2 on the surface of the metal. Author (NSA)

N71-20717* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

ELASTOMERIC SILAZANE POLYMERS AND PROCESS FOR PREPARING THE SAME Patent

James D. Byrd, inventor (to NASA) Issued 21 Nov. 1967 (Filed 31 May 1966) 3 p Cl. 260-2

(NASA-Case-XMF-04133; US-Patent-3,354,098; US-Patent-Appl-SN-554949) Avail: US Patent Office CSCL 07D

Elastomeric diamine silazane polymers are prepared by reacting a bifunctional amine with a diorganodihalogenosilane in the presence of an acid acceptor. An elastomeric polymer is readily obtained at a high yield in a one-step reaction process by this means. It is postulated that the elastomeric character of the product polymers results primarily from the formation of a relatively high proportion of ladder-and/or cyclic-type structures. The acid acceptor promotes the formation of these structures by reacting with and effectively removing the acid hydrohalide by-product formed in the polymerization reaction. The acid would otherwise interfere with the desired reaction and tend to terminate polymerization. The higher molecular weight obtained in the present process is another factor which contributes to the elastomeric character of the product. Official Gazette of the U.S. Patent Office

N71-20779*# Kentucky Univ., Lexington. Boiling and Phase-Change Lab.

DYNAMICS AND STABILITY OF ELECTROLYTIC BUBBLES: BUBBLE DEPARTURE DIAMETERS

Gautam Trivedi and James E. Funk 1970 35 p refs

(Grant NGR-18-001-035; Contract DAAB07-69-C-0366; Proj. Themis)

(NASA-CR-117481; AD-714302; UKY-28-70-ME-8) Avail: NTIS CSCL 07D

The work described is concerned with obtaining and interpreting bubble contact angles and bubble detachment diameters. It was the object of the work described to devise a method for growing gas bubbles (H2 and O2) on solid horizontal electrode surfaces (Platinum) and measuring the contact angles and the departure diameters. GRA

N71-20905* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

METHOD OF PRODUCING ALTERNATING ETHER SILOXANE COPOLYMERS Patent

James E. Curry, inventor (to NASA) Issued 10 Oct. 1967 (Filed 2 Nov. 1965) 3 p Cl. 260-2

(NASA-Case-XMF-02584; US-Patent-3,346,515; US-Patent-Appl-SN-506136) Avail: US Patent Office CSCL 07D

The polymerization of organic diols with stable silazanes or diaminosilazanes is discussed. The copolymers which are produced in a relatively short period of time have relatively high molecular weights, and are resistant to or stable at relatively high temperatures. The factors which contribute to obtaining copolymers displaying the aforementioned properties are the intermediates employed, diaminosilanes and diols, the method of polymerizing, the temperature at which polymerization is performed, the period of time for polymerization, and the fact the intermediates employed do not form low molecular weight cyclic products to the exclusion of high molecular weight linear polymers. Official Gazette of the U.S. Patent Office

N71-21069# Royal Netherlands Aircraft Factories Fokker, Amsterdam.

MEASUREMENT ON THE EFFECTS OF VACUUM OR RADIATION ON POLYMERS Progress Report, Apr. 1969

P. C. Van Der Waal and P. Rouppe Van Der Voort 23 Apr. 1969 11 p

(Contract ESTEC-647-69-AA)

(PR-4) Avail: NTIS

The technical progress of the measurement on vacuum and radiation effects on polymers at the Delft Facility up to the end of March 1970 is presented. The costs for the December 1969 to March 1970 period are estimated. ESRO

N71-21070# Royal Netherlands Aircraft Factories Fokker, Amsterdam.

MEASUREMENTS ON THE EFFECTS OF VACUUM OR RADIATION ON POLYMERS Progress Report, Nov. 1970

P. Van Der Waal and P. Rouppe Van Der Voort 2 Nov. 1970 9 p

(Contract ESTEC-647-69-AA)

(PR-6) Avail: NTIS

The technical progress up to 31st October 1970 on the program of measurement of vacuum or radiation effects on polymers is given. The financial progress shows the specification of expenditures covering the period 12th July up to and including October 3rd, 1970. The most important information is summarized as follows: some tests on films have been repeated in order to meet the requirements; it is suggested to start the preparation of tests on foams. Author (ESRO)

N71-21071# Royal Netherlands Aircraft Factories Fokker, Amsterdam.

MEASUREMENT ON THE EFFECTS OF VACUUM OR RADIATION ON POLYMERS Progress Report, Dec. 1969

P. C. Van Der Waal and P. Rouppe Van Der Voort 10 Dec. 1969 22 p

(Contract ESTEC-647-69-AA)

(PR-3) Avail: NTIS

The technical progress of the work performed at the Delft Facility on measurements of vacuum or radiation effects on polymers up to the end of November 1969 is reported and the costs are analyzed. ESRO

N71-21208# National Research Council of Canada, Ottawa (Ontario).

A CHEMICALLY INERT GEL [ETUDE D'UN GEL CHIMIQUEMENT INDIFFERENT]

Anne-Marie Biget 1970 33 p refs Trans. into ENGLISH from Ann. Chim. (Paris), Ser. 12, no. 5, 1950 p 66-105

(NRC-TT-1439) Avail: NTIS

The dual properties of a cellulose acetate gel are described including those which are inherent in the gel state, regardless of its chemical nature, and those which are due to the chemical properties of the dry substance of the gel. The cellulose acetate employed was the commercial one (soluble in acetone) with an ester function that is saponifiable by alkalis and is accessible to hydrolysis by acids but is inert to most salt solutions. Its chemical inertia gave it the properties necessary for it to act as the dry substance of a gel (practically inert). The acetate was brought to the gel state by exploiting its solubility in the concentrated solutions of certain mineral salts (perchlorates). Author

N71-21230# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DIALKYLDITHIOCARBAMATES OF METALS AS ANTIOXIDANTS FOR HYDROCARBONS

I. V. Shkhiyants et al 26 Aug. 1970 10 p refs Transl. into ENGLISH from Neftekhimiya (USSR), v. 9, no. 4, 1969 p 616–619

(AD-716971; FTD-HT-23-363-70) Avail: NTIS CSCL 7/3

A number of diethyl- and di-eta-butyldithiocarbamates of metals (nickel, zinc, lead, copper, and cadmium) were synthesized. A study was made of their comparative antioxidant activity. Under the conditions of the experiment these compounds completely inhibit the process of oxidation of paraffin-napthene hydrocarbons at 150 degrees. At 180 degrees the lead salts are the best antioxidants. Differential thermal analysis of these salts by means of a Kurnakov pyrometer showed that all the investigated salts begin to decompose at temperatures above 250 degrees. Author (GRA)

N71-21238 National Lending Library for Science and Technology, Boston Spa (England).

PRECIPITATION OF NICKEL AND COBALT SULPHIDES FROM CHLORIDE SOLUTIONS

V. S. Spitchenko 6 Jul. 1970 6 p refs Transl. into ENGLISH from Sb. Statei Aspir, Soiskateli, Min. Vyssh. Sredn, Spets. Obrazov Kaz. SSR, Met. Obogashch, no. 3, 1967 p 148–155 In ENGLISH and RUSSIAN

(NLL-Trans-746-542(9022-401)) Avail: Nat. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Conditions of deposition of nicel and cobalt sulfide from chloride solutions by hydrogen sulfide using magnesium oxide as a neutrilizer were investigated. The optimum temperature of the process was established as 60 to 65 C. From the experimental data, physical and chemical methods of analysis, and investigation of the literature material, it was established that, at the beginning of deposition, the process is limited by the rate of dissolution of hydrogen sulfide. According to the extent of the process with a decrease of the necessity for hydrogen sulfide, the deposition process transfers into the area limited by the formation of sulfides, which, at temperatures higher than 60 to 70 C, is determined by the diffusion of nickel and cobalt ions across the films of sulfides towards the surface of the magnesium oxide. Author

N71-21239 National Lending Library for Science and Technology, Boston Spa (England).

IR SPECTRA OF LOW SILICA SODIUM HYDROALUMINOSILICATES

T. I. Avdeeva et al 27 Jul. 1970 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Khim. (Moscow), no. 10, 1969 p 2197–2203

(NLL-RRE-Trans-288-(8036.47)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The IR absorption spectra of synthetic carbonate containing, low silica sodium hydroaluminosilicates, similar in structure to zeolite NaA, sodalite, and cancrinite, are investigated in the 3800 to 400/cm region. The spectra of the hydroaluminosilicates of various structural types are distinguished by the position of the bands in the region of the valence oscillations of the hydroxyl groups of water molecules (3600 to 3400/cm), of the carbonate ion (1500 to 1400/cm), and of the silicon-aluminum-oxygen framework (1200 to 400/cm). Differences in the IR spectra can be used for determination of the structural type of low silica sodium hydroaluminosilicates by using IR spectroscopy. Author

N71-21257# National Research Council of Canada, Ottawa (Ontario).

THE HYDRODIFFUSION OF THE CHLORIDES AND NITRATES OF CALCIUM, STRONTIUM AND BARIUM [KLORIDERNAS OCH NITRATENS AV METALLERNA KALCIUM, STRONTIUM OCH BARIUM HYDRODIFFUSION]

Lars W. Oeholm 1971 10 p refs Transl. into ENGLISH from Finska Kemistsameundets Medd. (Helsinki), v. 47, 1938 p 59–66

(NRC-TT-1443) Avail: NTIS

The measurements were made at three different temperatures, 11 to 12, 20 to 21 and 25 to 26 C, and the diffusion coefficients obtained were converted to 20 C with the temperature coefficients derived from the tests. The results are discussed with reference to other physico-chemical properties of these solutions and are compared with the diffusion coefficients of the chlorides and nitrates of other bivalent metals. Author

N71-21259 # National Research Council of Canada, Ottawa (Ontario).

THE ELECTROCHEMISTRY OF FINE-PORE CAPILLARY SYSTEMS. 5: STREAMING POTENTIALS. DONNAN HINDRANCE OF ELECYROLYTE TRANSFER IN FLOWS [ZUR ELEKTROCHEMIE FEINPORIGER KAPILLARSYSTEME. 5: STROEMUNGSPOTENTIALE. DONNAN-BEHINDERUNG DES ELEKTROLYTDURCHGANGS BEI STROEMUNGEN]

G. Schmid and H. Schwarz 1971 31 p refs Transl. into ENGLISH from Z. Elektrochem. (Leipzig), v. 56, no. 1, 1952 p 35–44

(NRC-TT-1442) Avail: NTIS

Streaming potentials at a series of collodion membranes of graduated pore size and membrane charge are measured in a .0002 N KCl solution and their conductivity data are calculated. Very good agreement is obtained. The theory also provides that, given ideal dilution and pore size, when an electrolyte solution is forced through a membrane under pressure, the concentration of the electrolyte emerging from the membrane immediately after application of the pressure will be reduced in the same proportion as the conductivity of the solution in the pores is increased compared with the external solution. In a prolonged flow the slowing effect gradually vanishes. This phenomenon, which is important in connection with ultrafiltration, is discussed in detail and is compared with the changes of potential occurring with the time in the measured streaming potential. Author

N71-21275 Minnesota Univ., Minneapolis.

THE INFLUENCE OF LARGE EXTERNAL GRADIENTS ON CATALYST PARTICLE BEHAVIOR

Ivan Copelowitz (Ph.D. Thesis) 1969 197 p

Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 70-5556

The effects of high temperature and composition gradients along the external surface of a catalyst particle are studied computationally. First order reactions are considered, and the analysis is carried out in terms of the effectiveness factor. The asymptotic case of large Thiele modulus is considered in terms of deviations from the behavior with uniform external conditions. More than three steady states are possible for a zeroth order reaction in a distributed parameter model of a homogeneous, spherical catalyst particle with no transfer resistance at the external surface. It is also here shown that this is true for first order kinetics 15 steady states being found for one set of parameters, and presumably for other orders of reaction too. Dissert. Abstr.

N71-21291# Naval Research Lab., Washington, D.C.

THE CATALYTIC DECOMPOSITION OF THE FIRE EXTINGUISHANT BROMOTRIFLUOROMETHANE, CBrF SUB 3

James K. Musick Nov. 1970 11 p refs

(AD-716737; NRL-MR-2189) Avail: NTIS CSCL 7/3

A study was made of the catalytic decomposition of bromotrifluoromethane, CBrF3, in air using a bench-scale reactor which simulates the CO/H2 catalytic burner of nuclear submarines.

There was no indication of thermal decomposition of CBrF3 in presence of stainless steel at temperatures up 700F. In contact with Hopcalite catalyst under conditions of the shipboard CO/H2 burner, there was no detectable decomposition of CBrF3 at 600F and 100 ppm influent concentration. The extent of decomposition of CBrF3 appeared to be 3% or less under the most severe conditions studied. The presence of CBrF3 in the air did not interfere with the oxidation of carbon monoxide by the catalytic burner. Author (GRA)

N71-21318 National Lending Library for Science and Technology, Boston Spa (England).
THE DISTRIBUTION OF AVERAGE CONCENTRATION OF CARBON DIOXIDE IN A GRAPHITE CHANNEL AT TEMPERATURES OF 1400 – 2400 K [RASPREDELENIE SREDNEI KONTSENTRATSII DVUOKISI UGLERODA V GRAFITOVOM KANALE PRI TEMPERATURAKH 1400 – 2400 K]
V. N. Nechaev et al Sep. 1970 9 p refs Transl. into ENGLISH from Khim. Tverdogo Topliva (USSR), v. 3, 1969 p 118 – 121
(NLL-RTS-5839) Avail: Natl. Lending Library, Boston Spa, Engl.: 18s; 3 NLL photocopy coupons

The results are given of investigations on the process of reduction of carbon dioxide in a mixture with argon in a graphite channel at 1400 to 2400 K and at rates of gas flow of 1.3, 4.3, and 7.0 m/sec with Re = 140 to 770. With a laminar flow it is possible to isolate more exactly the role of diffusion control of the heterogeneous reaction. On the basis of the experimental data, the reaction coefficients for the gas exchange and the average rate of the reaction of C + CO2 were calculated. Author

N71-21331 National Lending Library for Science and Technology, Boston Spa, (England).
EXPERIMENTAL DETERMINATION OF RATE OF REACTION OF GRAPHITE WITH CARBON DIOXIDE AT TEMPERATURES OF 1400 – 2400 K AND ATMOSPHERIC PRESSURE [EKSPERIMENTAL'NOE OPREDELENIE SKOROSTI VZAIMODEISTUIYA GRAFITA S DVUOKIS' YU UGLERODA PRI TEMPERATURAKH 1400 – 2400 K I ATMOSFERNOM DAVLENII]
V. N. Nechaev et al Sep. 1970 7 p refs Transl. into ENGLISH from Khim. Tverdogo Topliva (USSR), v. 6, 1968 p 180 – 183
(NLL-RTS-5838) Avail: Natl. Lending Library, Boston Spa, Engl.: 14s; 2 NLL photocopy coupons

The reaction between graphite VUM-1, heated treated at 2700 C, and carbon dioxide was studied in graphite flow tubes with inside diameter of 1.2 mm, wall thickness of 3.9 mm, and lengths of 30, 50, 80, 100, and 150 mm. The concentrations of carbon dioxide were 10, 25, 50, and 100%, and the flow velocities were 1.3, 2.9, and 4.3m/sec. The anomalous behavior of the specific reaction rate in the temperature range of 1400 to 2400 K was confirmed. The reaction is of the first order starting from 1750 K and the apparent energy of activation for the temperatures 1400 to 1700 K is 45 Kcal/mole. Author

N71-21334 National Lending Library for Science and Technology, Boston Spa (England).
INVESTIGATION OF THE STRUCTURE OF MACROMOLECULES OF AN ETHYLENE-VINYL ACETATE COPOLYMER BY THE METHOD OF INFRARED SPECTROSCOPY [ISSLEDOVANIE STROENIYA MAKROMOLEKUL SOPLIMERA ETILENA S VINILATSETATOM METODOM INFRAKRASNOI SPEKTROSKOPII]
A. L. Goldenberg et al Sep. 1970 10 p refs Transl. into ENGLISH from Vysokomol. Soedin (USSR), v. 9B, no. 7, 1967 p 542 – 546
(NLL-RTS-6021) Avail: Natl. Lending Library, Boston Spa, Engl.: 20s 3 NLL photocopy coupons

The results are presented of a study to determine the nature of the distribution of the monomer units in ethylene-vinyl acetate copolymers with the aid of IR absorption spectra. In the investigation, use was made of the dependence of the frequency of the rocking mode vibration of the CH2 groups on the number of these groups joined consecutively. The composition of the copolymers was determined by saponification and by element analysis. The theoretical curves were calculated for the dependence of the distribution of types of linkages on the composition of the copolymer. These data were then compared with the results obtained by the use of IR absorption spectroscopy. The results of the comparison indicate that in the environment of the acetate groups the rocking vibrations of the CH2 groups have lower wave number values, and that the decrease in the shift of the wave number values with increase in the number of CH2 groups is completely uniform. D.L.G.

N71-21356*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
POLYMER RESEARCH
In its Space Programs Sum. No. 37-66, Vol. 3, Oct. – Nov. 1970 31 Dec. 1970 p 187 – 200 refs (See N71-21338 10-30)
Copyright. Avail: NTIS CSCL 07C

A framework is derived for predicting the viscoelastic behavior of elastomers undergoing single instantaneous change in crosslink density during creep or stress relaxation experiments. The energy transfer in bipyridilium salts is investigated and compared with electron transport properties of aliphatic compounds with tetracyano quinodimethane salts. The electron conductivity mechanism of tetracyano quinodimethane salts of ionene polymers are studied and the details of syntheses and chemical analyses are shown in table form; highest specific resistivities and activation energies were found for salts derived from model compounds or polymers containing 6 CH2 groups. Also reported is an electrical measuring technique for determining quantitatively stick-slip of magnetic recording tapes from their speed. G.G.

N71-21362# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Chemistry.
STUDIES OF IONIC ASSOCIATION AND SOLVATION WITH LASER RAMAN SPECTROSCOPY
George J. Janz Dec. 1970 58 p refs
(Contract N00014-67-A-0117-0006)
(AD-717084; TR-6) Avail: NTIS CSCL 7/4

One of the central problems in non-aqueous electrolytes is the characterization of the interactions that exist among the constituent ions and among the ions and the solvent. This is an important problem because the structural, thermodynamic, and transport properties of aqueous and nonaqueous electrolytes and molten salts depend on the nature and the range of such interactions. In the present report, studies in some non-aqueous electrolytes are considered from this viewpoint starting with some observations of ionic association and electrical conductance since classically this was one of the first approaches and still continues to be one of the more important methods for characterizing ionic association in electrolytes. Author (GRA)

N71-21448# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
SOLID STATE PLUTONIUM DIFFUSION [DIFFUSION DU PLUTONIUM A L'ET AL SOLIDE]
Daniel Calais, Jean-Andre Cornet, Jean-Francois Cornet, Alain Languille, and Clotilde Remy 1970 13 p refs In FRENCH Presented at 4th Intern. Conf. on Plutonium and other Actinides, Santa Fe, N.Mex., 5 – 9 Oct. 1970
(CEA-CONF-1635; CONF-701001-12) Avail: AEC Depository Libraries

The increase in the self-diffusion of body-centered under a hydrostatic pressure of 0 to 20 kilobars was studied. The

activation energy remained a linear function of the melting point. The activation volume for the defects involved in the diffusion mechanism was negative (effect of lattice vacancies negligible). The compressibility of plutonium inferred from the measurement of Young modulus and Poisson coefficient by the ultrasonic resonance method was very large. The elastic theory would accommodate an appreciable relaxation of the vacancies with low but positive activation volumes. The contraction of Pu on melting is explained by a change in the electronic structure of the atom. From the energy point of view, the results obtained can be interpreted in elastic theory of a mechanism of diffusion by interstitials, the migration of the interstitial taking place by indirect process. NSA

N71-21450# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaire.

STUDY OF THE PLUTONIUM SCANDIUM SYSTEM (DIAGRAM AND PROPERTIES) [ETUDE DU SYSTEME PLUTONIUM SCANDIUM]

Alain Ballagny, Rene Boucher, and Claude Carrard 1970 11 p refs In FRENCH Presented at 4th Intern. Conf. on Plutonium and Other Actinides, Santa Fe, N.Mex., 5–9 Oct. 1970

(CEA-CONF-1631; CONF-701001-10) Avail: AEC Depository Libraries

The plutonium-scandium phase diagram was established. This structural determination was based on a study by X ray diffraction, metallography, dilatometry, and density measurements. The limits of the delta region at room temperature lie between 4.0 and about 20 at.% of scandium. The maximum solubility of scandium in the delta phase at 658 C is about 28 at.%. The temperature of the peritectoid transformation (delta yields epsilon + zeta) was found to be 658 + or − 3 C, and that of the second peritectoid transformation (zeta yields epsilon + alpha (scandium)) was 745 + or − 3 C. Properties such as crystal parameters, densities, thermal expansion coefficients, electrical resistivity, resistance to atmospheric oxidation between 20 and 400 C, hardness, and rolling capacity were examined. Tables are given of values relative to the following compositions: 3, 8, 10, 14, 17, 25, 50 and 70 at.% of scandium. Results of a more limited study on the properties of alloys containing between 70 and 100 at.% of scandium are included. Author (NSA)

N71-21487# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.

STUDY OF KINETIC METHODS OF CHEMICAL ANALYSES Final Report, 1 Nov. 1966–31 Oct. 1970

Dale W. Margerum and Harry L. Pardue Dec. 1970 8 p refs (Grant AF-AFOSR-1212-67)

(AD-717187; AFOSR-70-2914TR) Avail: NTIS CSCL 7/4

A brief summary is given of work which included (a) determination of metals and non-metals down to 10 to the -8th to 10 to the -9th M concentrations by catalytic methods, (b) multicomponent analyses in complex mixtures by differential and catalytic kinetic methods, (c) automation of rate measurements and computations to give digital readout in terms of concentration of components, (d) instrumentation for rapid analysis with measurement times of milliseconds (stopped-flow technique) to minutes, (e) development and utilization of a highly stabilized photometric instrument, and (f) achievement of precision and accuracy in the range of one to five percent relative error. Author (GRA)

N71-21490*# Florida Univ., Gainesville. Dept. of Chemical Engineering.

SYNTHESIS OF ELASTOMERS FOR USE WITH LIQUID FLUORINE Final Report

Henry C. Brown and A. R. Mukherjee Dec. 1970 1970 46 p (Contract NSR-10-005-047)

(NASA-CR-117498) Avail: NTIS CSCL 07D

The synthesis of elastomeric polymers that will be resistant to the strong oxidizing effect of fluorine, oxygen difluoride, nitrogen tetroxide and similar agents is discussed. In addition, it is desirable that the material be flexible at cryogenic temperatures. Attempts have been made to use some trialkyl or triaryl phosphines as initiators for ionic polymerization of hexafluorobutyne-2 and its copolymerization with some suitable comonomers. Being ionic in nature, the rate of homopolymerization was extremely fast even at very low temperature in some cases; in regard to copolymerization, little success has been achieved. Efforts have been made to copolymerize hexafluorobutyne-2 and tetrafluorethylene in the presence of dichlorohexafluorobutyne-2 and ultraviolet light as initiator with the monomers in different proportions. Author

N71-21568# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

STUDY OF CARBIDE TYPE COMPOUNDS: PHASE DIAGRAMS AND PROPERTIES [ETUDE DE COMPOSES DE TYPE CARBURE: DIAGRAMMES ET PROPRIETES]

Robert Lorenzelli, Pierre Delaroche, Maurice Housseau, and Pierre Petit 1970 18 p refs In FRENCH Presented at the 4th Intern. Conf. on Plutonium and Other Actinides, Santa Fe, N.Mex., 5–9 Oct. 1970

(CEA-Conf-1589; Conf-701001-6) Avail: AEC Depository Libraries

In order to improve the properties of the carbides (U,Pu)C, a study of the carbide-type compounds (carbides, nitrides, carbonitrides and oxicarbides) was made. These compounds were obtained by natural sintering in vacuum at temperatures from 1400 to 1750 C. The following phase diagrams: (U,Pu)C; (U,Pu)N; (U,Pu)C,N; (U,Pu)C,O; (U,Pu)N,O, were investigated for a Pu/(U + Pu) + Pu) ratio between 15 and 25 at %. The phase limits in the mixed (U,Pu) systems are very close to those of the equivalent uranium systems. The psuedo ternary phase diagram MC–MN–MO was studied. Properties, such as compatibility with cladding materials, thermal conductivity, and elastic constants were investigated. With a sodium band, it was shown that carburizing of a stainless steel (316 l) cladding remains low in all cases after a 4000 hour annealing at 700 C. In the case of carbonitrides, anomalies in thermal conductibility and Young's modulus are due to the nonideality of the solid solution (U,Pu)C,N on its nitrogen rich side. Author (NSA)

N71-21569# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

STUDY OF U-Pu-O SYSTEM [CONTRIBUTION A L'ETUDE DU SYSTEME U-Pu-O]

Guy Dean, Jean Claude Boivineau, Pierre Chereau, and Jean Pierre Marcon 1970 17 p refs In FRENCH Presented at the 4th Intern. Conf. on Plutonium and Other Actinides, Santa Fe, N.Mex., 5–9 Oct. 1970

(CEA-CONF-1637; Conf-701001-13) Avail: AEC Depository Libraries

Substoichiometric compounds of ratios Pu/U + Pu > 40 at.% and O/U + Pu < 2.00, prepared by sintering under an H2 atmosphere or under vacuum, were studied at room temperature and at high temperature. A moderate reduction by H2 led to a two-phase system: one phase remained face-centered cubic and the other, face-centered cubic becoming rhombohedral with a composition close to M7O12 for Pu concentrations around 60 at.% and a ratio O/U + Pu = 1.70. At high temperature, the two phases obtained for 1.80 < O/U + Pu < 1.96 were fcc in structure, one corresponding to the original fcc phase and the other to the rhombohedral phase. Examination of the thermodynamic quantities confirmed the nonideality of UO2–PuO2–z solid solutions and explained the disagreement observed on Delta G (02) between calculations and the vapor pressure measurements carried out at high temperatures. NSA

N71-21584 National Lending Library for Science and Technology, Boston Spa (England).

THE TREATMENT OF CONDENSATES WITH POWDERED

ION-EXCHANGE RESINS KU-2 AND AV-17 [OBRABOTKA KONDENSATOV POROSHKOOBRAZNYMI IONITAMI KU-2 I AU-17]

N. P. Subbotina et al Aug. 1970 13 p refs Transl. into ENGLISH from Vodopodgotorka, Vodn. Rezhim i Khimkontrolna Parosilovykh Ustanovkakh, (USSR), v. 3, 1969 p 140–146
(NLL-RTS-5981) Avail: Natl. Lending Library, Boston Spa, Engl.: 26s; 4 NLL photocopy coupons

The possiblity of using powered ion exchange resins as filters in condensate purification is investigated. Particular attention is given to technological and sorption features. Results indicate fractions of these resins with particle size 50 to 70 microns may be used as a filter medium for sand like filters for condensate purification operating at temperatures below 40 C. E.H.W.

N71-21659# Scientific Translation Service, Ann Arbor, Mich. Argonne National Lab., Ill.

ION AND ELECTRON MOTION IN SOLID SILVER SULFIDE, SILVER SELENIDE, AND SILVER TELLURIDE [IONEN UND ELEKTRONEN BEWEGUNG IN FESTEM SILBERSULFID, SILBERSELENID UND SILBERTELLURID]

Nilo Valverde Dec. 1970 11 p refs Transl. into ENGLISH from Z. Phys. Chem. (Frankfurt), no. 70(3-4), 1970 p 128–138 Prepared for Argonne Natl. Lab., Ill.
(ANL-TRANS-868) Avail: NTIS

A report is given on measurements of electron conductivity in alpha-Ag2Se at 150 C, alpha-Ag2Te at 160 C, beta-Ag2S at 150 C as well as beta-Ag2Se and beta-Ag2Te at 100 C as a function of the silver activity. In addition, data are given on ionic conductivity of beta-Ag2S, alpha-Ag2Se and alpha-Ag2Te as well as on the tracer diffusion coefficients of silver ions in beta-Ag2Se and beta-Ag2Te. Author

N71-21660# Sandia Corp., Albuquerque, N.Mex.

INVESTIGATION OF THE SPECTRA OF STOCHASTIC OPERATORS ARISING IN LATTICE MODELS OF A GAS

R. A. Minlos et al 1970 24 p refs Transl. into ENGLISH from Teor. Mat. Fiz., (USSR), v. 2, no. 2, 1970 p 230–243 Sponsored by AEC
(SC-T-71-3000) Avail: NTIS

The spectrum of the transfer matrix A sub L is studied for general form lattice models with finite interactions. A limiting stochastic operation is constructed which serves as the limit of the stochastic matrices obtained by natural normalization of the transfer matrix A sub L. For the operator P sub infinity with small values of the parameter beta, the first two invariant subspaces are found in one of which the spectrum of the operator P sub infinity agrees with the values of a certain function, and where the second contains values of a function and perhaps a certain number of segments. This result agrees well with the familiar work of Onsager, in which the spectrum P sub infinity was computed explicitly for the specific case of the Ising model. Author

N71-21661# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

THERMODYNAMIC PROPERTIES OF PLUTONIUM CARBIDES [PROPRIETES THERMODYNAMIQUE DES CARBURES DE PLUTONIUM]

Jean Pierre Marcon, Jean Poitreau, and Gilbert Roullet 1970 11 p refs In FRENCH Presented at 4th Intern. Conf. on Plutonium and Other Actinides, Santa Fe, N.Mex., 5–9 Oct. 1970
(CEA-CONF-1588; CONF-701001-7) Avail: AEC Depository Libraries

The following experimental methods have been investigated to gather more accurate data on free energies of formation of plutonium carbides: (1) vapor pressure measurements have been interpreted with reference to the known data relative to the Pu-C diagram; the utmost importance of oxygen, always present as an impurity, has been emphasized, (2) carbon monoxide pressure measurements at equilibrium above the domain Pu2O3-Pu2C3-C as a function of temperature yielded the free energy of formation of Pu2C3; and (3) calorimetry which requires the determination of the heat of formation at room temperature and the variation of specific heat with temperature. Author (NSA)

N71-21715*# Yale Univ., New Haven, Conn. Dept. of Chemistry.

EFFECTS OF SURFACE CROSSING IN CHEMICAL REACTIONS: THE H3(+) SYSTEM

Richard K. Preston and John C. Tully [1970] 31 p refs
(NGR-07-004-043)
(NASA-CR-117500) Avail: NTIS CSCL 07D

Approximate potential energy surfaces for the two lowest singlet states of H3(+) are calculated using a Cashion-Herschbach approach. The nonadiabatic terms which couple these surfaces can be directly computed in this approximation. From the magnitudes of these coupling terms it is apparent that, for excitation energies below about 10 eV, nonadiabatic transitions must be confined almost entirely to a region localized at the avoided crossing of the two surfaces. This fact suggests the following simplified picture of the dynamics of the H(+) + H2 reaction: As the H(+) + H2 in a low vibrational state approach, they remain on the lower potential surface (three is no initial electron jump). They continue to adiabatically follow the lower surface in the close-collision region, so the probability of nonadiabatic transition does not appear to be related to the lifetime of the collision complex. It is while the products are receding that electronic transitions become important. Consequences of this model on the threshold for formation of H2(+) and on the partition of vibrational energy in the products are discussed, and a comparison with recent experiments of Krenos and Wolfgang is included. Author

N71-21835 National Lending Library for Science and Technology, Boston Spa (England).

PHOTOCHEMICAL, MERCURY VAPOR SENSITIZED OXIDATION OF BENZENE IN THE GAS PHASE [FOTOKHIMICHESKOE, SENSIBILIZIROVANNOE PARAMI RTUTI, OKISLENIE BENZOLA V GAZOVOI FAZE]

O. M. Niazyan et al Aug. 1970 12 p refs Transl. into ENGLISH from Arm. Khim. Zh. (Armenia SSR), v. 20, no. 9, 1967 p 671–679
(NLL-RTS-5985) Avail: Natl. Lending Library, Boston Spa, Engl.: 24s; 4 NLL photocopy coupons

The photochemical, mercury vapor-sensitized oxidation of benzene in the gas phase is studied. It is shown that phenol and an organic peroxide of unknown structure are the reaction products. The temperature dependence of the accumulation rate of phenol is determined. It is established that the accumulation rate of phenol is described by the empirical equation $W = A/(B+C(PhH))$ where (PhH) is the benzene concentration. It is established that, under specific conditions, the accumulation rate of phenol can be a function of the time. Author

07 COMMUNICATIONS

Includes communications equipment and techniques, noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation

N71-20601# Helsinki Univ. (Finland). Radio Lab.

[ACTIVITIES OF THE RADIO LABORATORY AND ITS RECEIVING STATION] Annual Report, 1 Aug. 1969–31 Jul. 1970

M. Tiuri 1970 15 p refs
(IN-S-36-1970) Avail: NTIS

The Radio Laboratory's activities in the fields of electromagnetic theory, microwave theory and techniques, radio waves and antennas, radio astronomy and instrumentation, space research and technology are described. ESRO

N71-20602# Technical Univ. of Denmark, Lyngby. Lab. of Electromagnetic Theory.
[ACTIVITIES OF THE LABORATORY OF ELECTROMAGNETIC THEORY] Annual Report, 1 Aug. 1969 – 31 Jul. 1970
1970 30 p refs
(D-112) Avail: NTIS

The subjects included in the activity report of the Laboratory of Electromagnetic Theory are courses, publications, and research into the following: linear arrays, antennas, FM radar, and LSA oscillators. ESRO

N71-20651# Naval Research Lab., Washington, D.C.
COMPLEX RAY CONFIGURATIONS IN AN IONOSPHERE COMPOSED OF SPHERICAL SHELLS
Allen R. Miller 17 Dec. 1970 13 p refs
(AD-716983; NRL-7198) Avail: NTIS CSCL 20/14

In the document some complex ray configurations are treated using a simple ionospheric model, namely, spheres concentric with a spherical earth. Other simplifying assumptions are also made. Methods for finding takeoff angle of ray and length of ray path are given. Author (GRA)

N71-20677# Rome Univ. (Italy). School of Aerospace Engineering.
COMBINED WORD AND BIT SYNCHRONIZATION FOR PCM EXPERIMENTAL DATA TRANSMISSION SYSTEMS [SINCRONIZZAZIONE CONTEMPORANEA DI CIFRA E PAROLA NEI SISTEMI PCM PER LA TRASMISSIONE DI DATI SPERIMENTALI]
Giorgio Ravelli Jan. 1970 35 p refs In ITALIAN; ENGLISH summary Presented at the AIR-AIDA Congr., Milan, 5–8 Oct. 1967 *Its* Atti del Centro Ric. Aerospaziali No. 26
Avail: NTIS

The method consists of the transmission of a subcarrier for the synchronization of words and characters obtained by the sum of the sinusoids with frequencies equivalent to the repetition frequencies of words and characters respectively. On a second subcarrier, coherent with the first one, the PCM pulse packet is transmitted. At reception the synchronization signals are detected by a phase-lock loop filter with a very narrow noise band. The circuit is phase synchronized contemporary with both frequencies and gives as output the word and character synchronization signals. ESRO

N71-20693# Naval Research Lab., Washington, D.C.
DOPPLER SHIFT CONSIDERATIONS IN NAVAL SATELLITE COMMUNICATION SYSTEMS EMPLOYING SYNCHRONOUS SATELLITES Interim Report
W. E. Leavitt and R. A. Le Fande 3 Dec. 1970 53 p refs
(AD-716745; NRL-7147) Avail: NTIS CSCL 17/2

Possible doppler shifts due to motions of existing stationary satellites are shown to be as large as 212 Hz/GHz. When the contribution due to ships motion and headway are added, total shifts of 2.5 kHz at X band are possible. To avoid a severe penalty in synchronization acquisition time in operating pseudonoise or frequency hop modems now considered for Naval satellite communication, some type of automatic doppler shift compensation is required. Several compensation methods are described that cannot obtain exact correction without undue complexity but can reduce the compensation error to less than 24 Hz/kHz of beacon carrier doppler shift with relatively simple techniques. Problems of phase noise due to phase lock loop bandwidths required to track changes in doppler shift and local oscillator spectral purity remain as prime problem areas. Author (GRA)

N71-20711# Harry Diamond Labs., Washington, D.C.
GEOMETRICAL OPTICS AND THE DESIGN OF FEED MOTION SCAN, PARALLEL PLATE, RADAR ANTENNAS
James M. Meek Sep. 1970 34 p refs
(AD-717048; HDL-TM-70-20) Avail: NTIS CSCL 17/9

Design configurations of nonoscillatory feed, line-scan, parallel-plate radar antennas were explored. Some historically important designs are described as a basis for understanding several new, proposed antenna geometries. It is shown that the continuous-motion scanner developed by Lewis can be combined with many parallel-plate lenses and reflectors in various geometric layouts to obtain useful microwave antennas. Designs that would normally produce good radiation by combining the continuous-motion scanner and the cut, rolled, and folded sectoral horn-lens assemblies. The continuous-motion scanner can be combined with dielectric, metal-plate, and geodesic lenses. Multiple linear and nonlinear reflectors may be installed in the sectoral horn and planar reflectors may be used in some geodesic lenses to achieve compactness. Some of these oblique layouts are shown to be analogous to optical telescopes. Methods of reducing antenna size by folding over or rolling up flat portions of the sectoral horn are explained. Optical laws are shown to apply to the geometrical design of parallel-plate antennas and lenses. Coma and spherical aberration are defined and procedures for designing parallel-plate radar antennas are proposed. Choice of optical and radar system parameters and the interrelationship of such parameters as scan angle, focal length, beamwidth, scan rate, and physical dimensions are discussed. Fermats extremum principle is defined and some funadmental criteria for designing geodesic lenses are outlined. Author (GRA)

N71-20730# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CHANNEL PUNCH
V. L. Karkov 15 Sep. 1970 17 p Transl. into ENGLISH from Sb. Statey, Statist. i Elektron.-Vychislitelnaya Tekhn. v. Ekon. (USSR), no. 1, 1966 p 337–344
(AD-717035; FTD-MT-24-185-70) Avail: NTIS CSCL 17/2

The article deals with the equipment used by telegraph stations to transmit information manually and automatically. Author (GRA)

N71-20731# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE MILLSTONE HILL PROPAGATION STUDY: PROGRESS IN FY 1970 Technical Note, 1 Sep. 1969 – 31 Aug. 1970
J. V. Evans, ed. 2 Dec. 1970 115 p refs Prepared in cooperation with Bell Telephone Labs., Inc.
(Contract F19628-70-C-0230)
(AD-717156; TN-1970-20; ESD-TR-70-357) Avail: NTIS CSCL 17/9

The report summarizes propagation studies which were centered on the Millstone Hill Field Station where an 84 fully steerable parabolic reflector is to be employed for simultaneous angle-of-arrival measurements of signals at UHF and L-band. These measurements are expected to permit refraction effects introduced by the auroral regions of the ionosphere to be investigated. Work to date has largely been concerned with modifying the equipment in order to undertake the observations. A limited number of tracking observations have been carried out which yield useful measurements of angular scintillation. Additional measurements to study the extent and cause of auroral clutter have been undertaken. The Millstone Hill Thomson Scatter radar has also been employed

to study F-region irregular behavior associated with auroral precipitation and the presence of Traveling Ionospheric Disturbances.
Author (GRA)

N71-20780# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
THE DFVLR LIDAR SYSTEMS 1 AND 2 [DIE DFVLR-LIDAR-SYSTEME 1 UND 2]
Hans-Joachim Katerle, Rolf Schellhase, Christian Werner, and Horst Helbig Nov. 1970 77 p In GERMAN; ENGLISH summary
(DLR-MITT-70-18) Avail: NTIS; ZLDI Munich: 19.10 DM

The LIDAR (light detection and ranging) system 1 is described. During 1967 and 1968, ground based measurements of the backscatter were carried out for altitudes between 10 and 50 km. The transmitters are a ruby laser (6943 A) and a frequency doubled ruby laser (3471 A). The receiver consists of three parabolic mirrors with a 1.5 m mirror diameter and 0.65 m focal distance. Each of these mirrors can be used as a separate receiver. The LIDAR system 2 was specially built for use on board the German Navy research vessels "Planet" during the Atlantic Trade Wind Expedition (ATEX). Both systems are mobile. Author (ESRO)

N71-20781# Institute for Telecommunication Sciences, Boulder, Colo.
RECENT PUBLICATIONS BY THE STAFF OF THE INSTITUTE FOR TELECOMMUNICATION SCIENCES, 1 JULY 1968 – 1 MARCH 1971
Mar. 1971 40 p refs
Avail: Issuing Activity

External publications, research reports, book reviews, technical memoranda, and pending publications are listed. E.H.W.

N71-20791* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SIGNAL-TO-NOISE RATIO ESTIMATING BY TAKING RATIO OF MEAN AND STANDARD DEVIATION OF INTEGRATED SIGNAL SAMPLES Patent
Carl E. Gilchriest and Lucien A. Couvillon, Jr., inventors (to NASA) Issued 31 Oct. 1967 (Filed 15 Jul. 1965) 8 p Cl. 325-31 Sponsored by NASA
(NASA-Case-XNP-05254; US-Patent-3,350,643; US-Patent-Appl-SN-472372) Avail: US Patent Office CSCL 17B

A simple, novel automatic signal to noise ratio estimating system is described. The system, used for space communication, provides continuous monitoring of signals received and estimates the signal to noise ratio from which the operation of various phases of communication system may be evaluated. The ratios are also used to automatically derive various performance parameters, and as a reference signal for the modulation index in the communication system. E.H.W.

N71-20814* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ELIMINATION OF FREQUENCY SHIFT IN A MULTIPLEX COMMUNICATION SYSTEM Patent
Gary L. Parker, inventor (to NASA) Issued 16 Jan. 1968 (Filed 7 Feb. 1964) 8 p Cl. 179-15 Sponsored by NASA
(NASA-Case-XNP-01306; US-Patent-3,364,311; US-Patent-Appl-SN-343426) Avail: US Patent Office CSCL 17B

A multiplexed communication system suitable for carrying data requiring end-to-end frequency coherence is described including means for automatically correcting transmission errors introduced by frequency spectrum shifts. The system includes means for generating a pair of test signals whose frequencies are discretely related and transmitting these signals over the same channel along with the data to be transmitted. By shifting the frequency of both the data and test signals at the receiving end to cause the frequencies of the pair of test signals to assume the same discrete relationship at the receiving end as was assumed at the sending end, the data is correctly repositioned in the frequency spectrum.
Official Gazette of the U.S. Patent Office

N71-21053# Technical Univ. of Denmark, Lyngby. Lab. of Electromagnetic Theory.
ADMITTANCE OF A THICK ANTENNA: NUMERICAL PROCEDURE AND RESULTS
J. Jacobsen and R. A. Hurd Nov. 1969 69 p refs
(R-74) Avail: NTIS

Details on the numerical evaluation of certain integrals occurring in an antenna admittance problem are given and numerical output and admittance curves are presented. Author (ESRO)

N71-21054# AEG-Telefunken, Ulm (West Germany). Fachbereich Schiffbau, Flugwesen, Sondertechnik.
A FEASIBILITY STUDY OF A SCANNING IR-RADIOMETER FOR USE IN AN OPERATIONAL METEOROLOGICAL SATELLITE Final Report
W. Fibich and J. Helm [1970] 95 p refs
(Contract ESTEC-853-69-HP)
Avail: NTIS

The preferred design of the scanning radiometer scans the earth or cloud surfaces with two rotating mirrors. Each of them illuminates after focusing in a mirror objective of Cassegrainian type two independent visible and IR-detectors. Therefore a redundancy of the signals from the detectors and their amplifiers is given. The reliability is from this point of view higher than that given in the MTBF calculation. The proposed scanning radiometer needs for online transmission only one transmitter of the visible range and the IR-picture excellently adapted to the APT-system. The data of the IR-scans of one orbit can be stored by a tape recorder. In playback these stored data are given with high speed transmission to the ground station. Author (ESRO)

N71-21102*# Air Force Avionics Lab., Holloman AFB, N.Mex. Detachment 1.
OVERVIEW OF THE AF AVIONICS LABORATORY REENTRY ELECTROMAGNETICS PROGRAM
Robert Rawhouser *In* NASA. Langley Res. Center The Entry Plasma Sheath and its Effects on Space Vehicle Electromagnetic Systems, Vol. 1 1970 p 3–17 (See N71-21101 10-25)
Avail: NTIS HC$9.00/MF$0.95 CSCL 20I

Studies of wave propagation through plasma since 1959 are reported. Interest was initially generated by the Dyna Soar program, which was to be a manned space vehicle. Model tests were run in the hotshot tunnels. More significant than the results was the realization of the magnitude of the problem. A program was inaugurated to study the problem from numerous approaches, and many theoretical problems were solved. Shock tube and tunnel experiments on various configurations yielded results. Reflectometers to yield antenna impedance measurements in the presence of plasma were installed on some early Atlas missiles, ASSET vehicles, and Trailblazer 2 vehicles. Four Trailblazers were instrumented and flown to obtain data on wave propagation through plasma and plasma noise. Considerable effort was placed on methods of alleviating the effects of plasma. Methods chosen for the program were the aerodynamic gas spike, a strong steady magnetic field, and the modulated electron beam. The latter two were difficult to instrument. In addition, the laboratory sponsored two Athena missile flights to investigate plasma influence on electromagnetic countermeasures. Author

N71-21103*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
OVERVIEW OF RAM REENTRY MEASUREMENTS PROGRAM

Norman D. Akey *In its* The Entry Plasma Sheath and its Effects on Space Vehicle Electromagnetic Systems, Vol. 1 1970 p 19–31 refs (See N71-21101 10-25)
Avail: NTIS HC$9.00/MF$0.95 CSCL 20I

In the radio attenuation measurements project, velocity regimes up to 25,000 ft/sec were studied theoretically, and carefully controlled ground and flight measurements were provided for development and improvement of these theoretical concepts. Several methods for maintaining communications during the blackout period were demonstrated. Related phenomena such as rocket exhaust attenuation were also studied. Author

N71-21105*# Harvard Univ., Cambridge, Mass.
INVESTIGATIONS ON A CYLINDRICAL ANTENNA AS A DIAGNOSTIC PROBE FOR ISOTROPIC AND MAGNETIZED PLASMAS
L. D. Scott, Bharathi Bhat, and B. Rama Rao *In* NASA. Langley Res. Center The Entry Plasma Sheath and its Effects on Space Vehicle Electromagnetic Systems, Vol. 1 1970 p 47–56 refs Prepared in cooperation with Lincoln Lab., MIT (See N71-21101 10-25)
Avail: NTIS HC$9.00/MF$0.95 CSCL 09E

Investigations are reported on the impedance behavior of a short, cylindrical antenna in the vicinity of the resonance and cut-off frequencies of a weakly ionized, collision-dominated plasma. The impedance results are utilized to explore the possibility of using such an antenna as a diagnostic probe for measuring plasma parameters. Since the antenna is electrically short, the values of the electron density and collision frequency are averaged over the near field region of the antenna, the dimensions of which are quite small, so that it becomes possible to get information on the local characteristics of the plasma. An RF probe of this type is likely to be useful for diagnostic measurements in high pressure, rare gas laboratory discharge plasmas, shock tube plasmas, some types of reentry plasmas, and also in the D-region of the ionosphere. Author

N71-21109*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RAM C-3 S-BAND DIAGNOSTIC EXPERIMENT
C. T. Swift, F. B. Beck, J. Thomson, and S. L. Castellow, Jr. *In its* The Entry Plasma Sheath and its Effects on Space Vehicle Electromagnetic Systems, Vol. 1 1970 p 137–155 refs (See N71-21101 10-25)
Avail: NTIS HC$9.00/MF$0.95 CSCL 17B

The RAM C-3 S-band diagnostic antenna was successfully flown on 30 September 1970. As the payload descended into the atmosphere, the electron density exceeded the critical value which resulted in a rise in reflection coefficient and an attenuation of the transmitted signal. When water and an electrophilic were injected into the flow, improved signal transmission and a lowering of the reflection coefficient were observed to occur. At the lower altitudes, the electrophilic seems to spread or diffuse around the payload more than water does and was very effective in removing electrons contiguous with the surface of the vehicle. Author

N71-21110*# Stanford Research Inst., Calif.
SHOCK TUBE MEASUREMENT OF ADMITTANCE OF RAM C AND RAM C-C DIAGNOSTIC ANTENNAS
W. C. Taylor *In its* The Entry Plasma Sheath and its Effects on Space Vehicle Electromagnetic Systems, Vol. 1 1970 p 157–182 refs (See N71-21101 10-25)
Avail: NTIS HC$9.00/MF$0.95 CSCL 09E

A program of measurements was performed in a 12-inch shock tube to determine the accuracy of inferring electron density from measurements of the admittance of three different antennas used in the RAM flight test program. Measurements were made at air densities corresponding to approximately 125,000 and 175,000 feet altitude. Electron density was varied from 5 × 10 to the 10th to 10 to the 13th/cu cm. Within a factor of two in electron density, admittance agreed with theoretical calculations for all three antennas except for conductance at overcritical densities, which was always higher than calculated. However, the results showed that susceptance is a good indicator of peak electron density in the above-critical regime. Author

N71-21111*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF REENTRY PLASMA ON RAM C-1 VHF TELEMETRY ANTENNAS
William F. Croswell and W. Linwood Jones, Jr. *In its* The Entry Plasma Sheath and its Effects on Space Vehicle Electromagnetic Systems, Vol. 1 1970 p 183–201 refs (See N71-21101 10-25)
Avail: NTIS HC$9.00/MF$0.95 CSCL 17B

Upon careful inspection of the VHF signal strength recorded at several ground stations during the RAM C-1 flight, antenna pattern changes are noted that are uniquely related to observer aspect angles. These aspect angles range from 75 deg to 88 deg when the receiving station is located broadside to the RAM configuration, and the aspect angle is 0 deg when the receiving station is directly down range (nose on). The antenna pattern changes are shown to occur in the altitude-velocity interval where the electron density, inferred from a rake of electrostatic probes, is equal to critical electron density occurring over the antenna physical aperture and where the corresponding measured reflected power from the same antennas rises to very large values. Author

N71-21119*# Aerospace Corp., Los Angeles, Calif.
ANALYSIS OF VHF AND X-BAND TELEMETRY SYSTEMS DEGRADATION BY REENTRY ENVIRONMENT
Kurt E. Golden and Donald A. McPherson *In* NASA. Langley Res. Center The Entry Plasma Sheath and its Effects on Space Vehicle Electromagnetic Systems, Vol. 1 1970 p 359–377 refs (See N71-21101 10-25)
(Contract F04701-70-C-0059)
Avail: NTIS HC$9.00/MF$0.95 CSCL 17B

A self-consistent technique utilizing the received signal strengths of both the VHF and X-band transmitters was used. It was determined that the attenuation was caused by electrons flowing back over the antennas from the stagnation region at the nose. For the X-band signal, the attenuation was a result of pattern distortion caused by refraction in the plasma layer and distortion of the field distribution in the antenna aperture. At VHF, the plasma layer is electrically thin, and the signal loss resulted from the combined effects of reflection and absorption. Author

N71-21120*# Stanford Research Inst., Calif.
ANTENNA PERFORMANCE IN THE PRESENCE OF A TURBULENT PLASMA
J. B. Chown *In* NASA. Langley Res. Center The Entry Plasma Sheath and its Effects on Space Vehicle Electromagnetic Systems, Vol. 1 1970 p 379–410 ref Sponsored in part by SAMSO (See N71-21101 10-25)
Avail: NTIS HC$9.00/MF$0.95 CSCL 09E

Diagnostic data to describe the plasma turbulent characteristics for use in theoretical models were obtained using the spatial resolution capabilities of ion probes. In addition to pattern measurements on single- and dual-slot X-band arrays, data were obtained concerning the effect of the plasma on the reflected signal from slot antennas and coupling of signal to adjacent slots in the array. The ratio of peak to critical plasma density was varied from 0.2 to 4. The collision frequency was 1.5 × 10 to the 10th power. In general, the radiation patterns obtained using the mean signal level for all antenna configurations could be explained on the basis of a laminar plasma model using the mean density contours of the

turbulent plasma. The principal effect of the turbulent medium was phase and amplitude modulation. Author

N71-21121*# Aerospace Corp., El Segundo, Calif.
RADIATION FROM CIRCUMFERENTIAL SLOTS ON PLASMA-CLAD CONES
Gordon E. Stewart, Kurt E. Golden, and David C. Pridmore-Brown *In* NASA. Langley Res. Center The Entry Plasma Sheath and its Effects on Space Vehicle Electromagnetic Systems, Vol. 1 1970 p 411–425 refs (See N71-21101 10-25)
Avail: NTIS HC$9.00/MF$0.95 CSCL 09E

The radiation pattern distortion produced by a high altitude, boundary layer plasma is investigated for both symmetrically and asymmetrically excited circumferential slot antennas on models of conical reentry vehicles that use an electric discharge simulation of the sheath. The slot configurations are selected to conform to nose-mounted telemetry antennas in current use, and the peak electron densities and electron density profiles are selected to approximate high altitude reentry conditions. Measured patterns and theoretical predictions are compared for both bare and plasma-clad cones. These indicate large modifications of the radiation pattern in the forward direction, even for relatively thin and underdense plasmas. Author

N71-21122*# Lockheed Missiles and Space Co., Palo Alto, Calif.
ELECTROMAGNETIC WAVE PROPAGATION IN A LOSSY PLASMA SLAB WITH A GRADIENT TRANSVERSE TO THE INCIDENT WAVE
George Gal *In* NASA. Langley Res. Center The Entry Plasma Sheath and its Effects on Space Vehicle Electromagnetic Systems, Vol. 1 1970 p 427–448 refs (See N71-21101 10-25)
Avail: NTIS HC$9.00/MF$0.95 CSCL 20N

A computer solution of the interaction of a plane electromagnetic wave with a bounded inhomogeneous plasma slab is described. Both TM and TE polarization are treated. Transmission and reflection coefficients are obtained and, in addition, refractive defocusing introduced by the transverse gradient is calculated for a number of electron density distributions. This basic solution is then applied to a bounded plasma slab, flow with a moving shock and communication through a plasma layer. Author

N71-21123*# Air Force Weapons Lab., Kirtland AFB, N.Mex.
AN AUTOMATIC ANTENNA IMPENDANCE MATCHER FOR REENTRY VEHICLE APPLICATIONS
John S. Potts (New Mexico Univ., Albuquerque), Walter M. Hart, Jr., and Edward S. Bocian, Jr. *In* NASA. Langley Res. Center The Entry Plasma Sheath and its Effects on Space Vehicle Electromagnetitic Systems, Vol. 1 1970 p 449–463 refs (See N71-21101 10-25)
Avail: NTIS HC$9.00/MF$0.95 CSCL 09E

An antenna impedance compensator which can automatically maximize the power radiated from an X-band antenna into a time-varying reflective medium is described. The compensator consists of a reflectometer for sensing the complex reflection coefficient of the antenna, two variable ferrite phase shifters which function as an electronic slide screw tuner, and a feedback circuit which processes signals from the reflectometer for use by the tuner. The compensator provides up to a 6 db improvement in radiated power for a voltage reflection coefficient of 0.97 and responds to any mismatch in less than 3 milliseconds. It is concluded that this technique can provide an effective solution to the communications blackout problem for highly reflective time-varying reentry plasma conditions. Author

N71-21124*# RCA Victor Co., Ltd., Montreal (Quebec).
PROPAGATION OF STRONG FIELD MODULATED ELECTROMAGNETIC WAVES IN PLASMAS
M. P. Bachnyski and B. W. Gibbs *In* NASA. Langley Res. Center The Entry Plasma Sheath and its Effects on Space Vehicle Electromagnetic Systems, Vol. 1 1970 p 465–478 refs (See N71-21101 10-25)
(Contract F19628-67-C-0206)
Avail: NTIS HC$9.00/MF$0.95 CSCL 20N

The distortion of the waveform of a modulated plane electromagnetic wave propagating in an anisotropic plasma has been experimentally investigated over a range of field strengths of the wave and plasma properties. By using right-hand circularly polarized waves, the effective frequency is the absolute difference between the RF radian frequency and the electron cyclotron frequency) and hence the results are also applicable to the propagation of low frequency waves in an isotropic plasma. Severe overmodulation of the waveform transmitted through the plasma is found where the ratio of the effective RF frequency to the effective collision frequency for momentum transfer is less than one. The distortion of the waveform is found to increase with depth of modulation of the incident wave and decrease with increasing modulation frequency. The demodulation is in qualitative agreement with theory for an unmodulated wave with a non-Maxwellian velocity distribution for the electrons. Many of the effects of the modulation frequencies can also be qualitatively predicted by considering the variation of electron temperature in the presence of the strong field modulated wave. Author

N71-21126*# Aerospace Corp., El Segundo, Calif.
THE EFFECTS OF SPATIAL NONUNIFORMITIES ON HIGH TEMPERATURE MICROWAVE BREAKDOWN
Glenn C. Light *In* NASA. Langley Res. Center The Entry Plasma Sheath and its Effects on Space Vehicle Electromagnetic Systems, Vol. 1 1970 p 489–508 refs (See N71-21101 10-25)
Avail: NTIS HC$9.00/MF$0.95 CSCL 09E

Results from a numerical solution of the Boltzmann equation that includes inelastic collision processes appropriate for air at high electric field strengths were recently reported. The values presented of the fundamental breakdown parameters, ionization frequency, collision frequency, and diffusion coefficient differ from those used in the classical phenomenological breakdown theory. The effect of these new values on breakdown are reevaluated quantitatively. Calculations for X-band antenna breakdown in an underdense reentry plasma are also presented. Reentry boundary layers typical of slender, sharp-nosed cones are treated. Results are compared for various simplifying assumptions: uniform gas properties, uniform electric field, and no high temperature effect. Author

N71-21129*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
STUDIES OF ELECTRON ATTACHMENT FOR THE ALLEVIATION OF RADIO COMMUNICATIONS BLACKOUT
R. L. Cowperthwaite, H. Myers, and E. P. Bialecke *In* NASA. Langley Res. Center The Entry Plasma Sheath and its Effects on Space Vehicle Electromagnetic Systems, Vol. 1 1970 p 559–577 refs (See N71-21101 10-25)
(Contract F19628-70-C-0134)
Avail: NTIS HC$9.00/MF$0.95 CSCL 20I

The removal of electrons from reentry flow fields by dissociative attachment is examined. Below electron concentrations of approximately 10 to the 14th power/sq cm, and for attachment times in the range of 1–100 microseconds, electron conversion is rate-determined and insensitive to the initial electron density. Additive number densities in the range 10 to the 13th to 10 to the 15th power particles/sq cm are required to reduce the electron number density to 10 to the 9th power/sq cm. Dissociative attachment cross sections are described by a model that depends mostly on the electron energy. A substantial number of peak cross sections are found to be consistent with the model, with model parameters independent of the target molecule. Further, the model gives the energy dependence of the cross section. The attachment model is then extended to include rotational effects for the case of diatomic molecules. Author

N71-21210# Ohio State Univ., Columbus. Dept. of Electrical Engineering.

THE LINEAR SEPARABILITY OF MULTIPLE FREQUENCY RADAR RETURNS, WITH APPLICATIONS TO TARGET CLASSIFICATION

Andrew G. Repjar 16 Nov. 1970 106 p refs
(Contract AF-AFOSR-1710-69)
(AD-717198; OSURF-2768-5; AFOSR-70-2928-TR) Avail: NTIS CSCL 17/9

Methods are presented for distinguishing and identifying object classes from a limited number of radar measurements. The radar measurements are the backscattered signal amplitudes at up to twelve harmonically related frequencies in the lower portion of the objects spectrum. The amplitudes of n radar returns of an object are defined as an n-dimensional vector. A class of vectors is defined for each object by a representative set of vectors which cover the various aspects of the objects. The classes of vectors corresponding to different objects are linearly mapped into a beta-space of reduced dimension. The separability of these points in beta-space is demonstrated, indicating a correct object classification. The maximum and average probabilities of misclassification are derived for classes immersed in gaussian noise. Mapping methods are derived which minimize classification errors. The probability of misclassification is shown to increase, but non-uniformly as the dimensionality of the n-space is reduced, indicating that the returns at higher frequencies do not contribute as significantly to the reduction of the probability of error as the lower frequencies. Finally it is shown that the techniques used for improving the noise resistance of pairwise classifiers apply also to multiclass classifiers. Author (GRA)

N71-21213# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

LOW ANGLE RADAR SEA RETURN AT 3-mm WAVELENGTH Final Report

Wayne Rivers 15 Nov. 1970 84 p refs
(Contract N62269-70-C-0489)
(AD-717082; GIT-A-1268) Avail: NTIS CSCL 17/9

Measurements of the radar return from the sea and targets on the sea were made at incidence angles near grazing with a 3-millimeter radar. The results show similarities in many respects to sea return at longer wavelengths, but they are strikingly different in a few instances. Notable are that the trend for cross section per unit area to increase with decreasing wavelength from 10 to 3 cm is not continued between 3 cm and 3 mm, and that the return for vertical polarization is substantially less than that for horizontal polarization for all conditions observed. Also included in the study are indications of angle, wind-speed, and boresight-wind-vector angle dependences of sea return. Author (GRA)

N71-21258# Joint Publications Research Service, Washington, D.C.

FAIRINGS FOR AIRCRAFT ANTENNAS

B. A. Prigoda et al 12 Mar. 1971 10 p Transl. into ENGLISH from Obtekateli Antenn Letatel'nykhapporatov (Moscow), 1970 p 181–192
(JPRS-52608) Avail: NTIS

Calculations of electromagnetic wave transmission through a curvilinear dielectric wall and for fairing with optimal transparency are discussed. Cylindrical, hemispherical, conical, and ogival fairings are considered. A device is described for speeding the calculations of the angles of incidence of the beams on the fairing wall, and only the center portion of the fairing, receiving most of the radiation, is used in the calculations. N.E.N.

N71-21276 Colorado Univ., Boulder.

ACOUSTIC GRAVITY WAVES IN THE IONOSPHERE AND THEIR EFFECTS ON HIGH FREQUENCY RADIO PROPAGATION

Norman Jun Fai Chang (Ph.D. Thesis) 1969 264 p
Avail: Univ. Microfilms: HC $11.95/Microfilm $3.40 Order No. 70-5828

An analytical investigation is made of the propagation of acoustic-gravity waves in the 1962 U.S. Standard Atmosphere. Atmospheric ray tracing shows that gravity waves reaching for F region from sources below the mesopause must propagate at angles near the maximum (asymptotic) value. The observed horizontal velocities of traveling ionospheric disturbances have minima during the summer months. Infrasonic waves with periods as small as 20 seconds were detected n the F region. Ionospheric 3 minute infransonic waves which originate in severe thunderstorms were studied, and it is shown that the east-west radio paths in the northern hemisphere the radio effect of acoustic waves is a maximum when the source is located north of the midpoint of the radio path. At ionospheric heights energy flux in internal gravity waves. The specular reflection model is valid for radio signals when the radio wave is incident steeply on the ionosphere. Dissert. Abstr.

N71-21299*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DEVELOPMENT OF LOW COST RECEIVING SYSTEMS FOR TELEVISION SIGNALS TRANSMITTED FROM SYNCHRONOUS SATELLITES

Edward F. Miller 1971 14 p refs Proposed for presentation at Symp. on Long Term Prospects for Satellite Commun., Genoa, 2–4 Jun. 1971; Sponsored by Ist. Intern. Delle Comunicazioni
(NASA-TM-X-67800; E-6248) Avail: NTIS CSCL 17B

The results are presented of developments the area of low-cost ground receiving systems suitable for the reception of television signals transmitted from synchronous satellites. The systems described receive microwave signals from satellites and perform conversion on the carrier frequency and the modulation format to produce signals compatible with conventional VHF-UHF television receivers. The receiving systems studied connect to conventional VHF-UHF television sets. Satellite transmission frequencies near 2.5 and 12 GHz were considered, in order to cover the range of receiver technologies that might be required. The signals transmitted from the satellite might be either frequency modulated or amplitude modulated with vestigial sidebands. Receivers to accommodate both modulation formats were designed. Author

N71-21343*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

COMMUNICATIONS SYSTEMS RESEARCH

In its Space Programs Sum. No. 37-66, Vol. 3, Oct.–Nov. 1970 31 Dec. 1970 p 18–42 refs (See N71-21338 10-30)
Copyright. Avail: NTIS CSCL 17B

A binary coded phase-locked loop system is reported that regenerates the ranging signal of a spacecraft for transmission to the ground; this clean-up loop locks on the received ranging signal and generates a replica of the received ranging code. Frequency offset and a second-order loop integrator with various damping ratios provide for the phased loop to remain in lock with the original input signal if signal input is lost due to fading or accidents. Evaluation of the best performance possible by an N-channal phase-shift-keyed/phase-modulated digital coherent system established the Interplex and a conventional method using linear combination of data streams as optimal modulation systems. A combinatorial geometry is used to determine the largest dimensions possible for a linear code of fixed length and minimum distance. G.G.

N71-21344*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

COMMUNICATIONS ELEMENTS RESEARCH

In its Space Programs Sum. No. 37-66, Vol. 3, Oct.–Nov. 1970 31 Dec. 1970 p 43–49 refs (See N71-21338 10-30)
Copyright. Avail: NTIS CSCL 17B

The effects of various errors on the gain of antennas representable by a field distribution over an aperture are discussed.

with particular reference to parabolic reflectors and lenses The related subject of pattern degradation has not been considered. The subject of antenna tolerance has been studied extensively. Some of the more interesting works are cited in references. Author

N71-21345*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACECRAFT TELECOMMUNICATIONS SYSTEMS
In its Space Programs Sum. No. 37-66, Vol. 3, Oct.–Nov. 1970 31 Dec. 1970 p 50–69 refs (See N71-21338 10-30)
Copyright. Avail: NTIS CSCL 17B

Theoretical work considered the following topics: (1) permissible data rates and second-order tracking loop stability in the presence of arbitrary time delay; (2) time-limited functions for minimizing intersymbol interference in single-sideband phase-modulated communication systems; (3) mathematical model of coarse bit synchronizer for data-aided receiver insteady state performance of first-order digital phase-locked loop; and (4) optimum modulation index for a data aided, phase coherent communication system. G.G.

N71-21381# Radio Corp. of America, Moorestown, N.J. RCA Missile and Surface Radar Div.
AN/PPS-18 XN-1 ULTRA RELIABLE RADAR Interim Development Report, 1–30 Nov. 1970
J. D. Frattura 8 Dec. 1970 22 p
(Contract N00039-70-C-3502)
(AD-717044; IDR-10) Avail: NTIS CSCL 17/9

The program covers the study, design, construction, test analysis and inspection of a complete and operative, highly reliable, relative failure-free version of the pulsed Doppler surveillance AN/PPS-6 radar set. The radar set is intended to be a lightweight, miniaturized, X-band, pulse Doppler combat surveillance radar. The basic purpose of the program is to develop a highly reliable radar set considering the overall cost of ownership when development, production and maintenance costs are taken into account while keeping the same general performance, form-factor and weight as the AN/PPS-6 radar. Author (GRA)

N71-21409# Advisory Group for Aerospace Research and Development, Paris (France).
TROPOSPHERIC RADIO WAVE PROPAGATION, PART 1 Conference Proceedings
H. J. Albrecht, ed. Feb. 1971 309 p refs Mostly in ENGLISH; partly in FRENCH AGARD Avionics Panel 16th Tech. Symp. held in Dusseldorf, 31 Aug.–4 Sept. 1970
(AGARD-CP-70-71-Pt-1) Avail: NTIS

Electromagnetic wave propagation through the troposphere is analyzed for the effects of tropospheric characteristics on wave refelection and refraction, scatter propagation, and propagation vediction methods. For individual titles, see N71-21410 through N71-21433.

N71-21410# Advisory Group for Aerospace Research and Development, Paris (France). Communications – Electronics Div. of the Military Committee.
MILITARY APPLICATIONS OF RESEARCH AND DEVELOPMENT IN TROPOSPHERIC WAVE PROPAGATION
Enrico Scotti (Italian Army) *In its* Tropospheric Radio Wave Propagation, Pt. 1 Feb. 1971 4 p (See N71-21409 10-07)
Avail: NTIS

An overview of military applications of tropospheric propagation phenomena in scatter communications and radar is presented with emphasis on the problems encountered by military communications, sensor systems command and control, frequency planning and the NATO integrated communications system is discussed. A better correlation of the known aspects of tropospheric propagation so as to best support military systems planning is advocated. Author

N71-21413# General Electric Co., Syracuse, N.Y.
TROPOSPHERIC EFFECTS ON SPACE COMMUNICATIONS
George H. Millman *In* AGARD Tropospheric Radio wave Propagation, Pt. 1 Feb. 1971 30 p refs (See N71-21409 10-07)
Avail: NTIS

The influence of the natural environment is considered in the design of an earth satellite communication system. The nonisotropic characteristics of the troposphere are evaluated in terms of their effects on the propagation of electromagnetic waves through the medium. The tropospheric propagational phenomena which are discussed are refraction, time delay, scintillation effects, doppler frequency shift, ducting, attenuation, and noise. Author

N71-21414# Stanford Research Inst., Calif. Aerophysics Lab.
SATELLITE VIEWED CLOUD COVER AS A DESCRIPTOR OF RADIO-RADAR PROPAGATION CONDITIONS
R. H. Blackmer, Jr. and S. M. Serebreny *In* AGARD Tropospheric Radio Wave Propagation, Pt. 1 Feb. 1971 12 p (See N71-21409 10-07)
Avail: NTIS

Comparison is made between the appearance of a satellite viewed cloud cover and radio-radar propagation conditions to determine whether cloud cover can describe atmospheric conditions influencing radio-radar propagation. Radar performance records from the eastern Pacific Ocean and tropospheric scatter signals from the southwestern Pacific ocean were compared with satellite photographs of cloud cover over the respective areas. It is shown that the nature of the cloud cover helps to indicate whether propagation will be normal or abnormal but more research is needed to obtain quantitative propagation data over small scale areas. Author

N71-21415# Air Force Cambridge Research Labs., Bedford, Mass.
RAIN ATTENUATION AT MILLIMETER WAVELENGTHS
E. E. Altshuler, V. J. Falcone, and K. N. Wulfsberg *In* AGARD Tropospheric Radio Wave Propagation, Pt. 1 Feb. 1971 10 p refs (See N71-21409 10-07)
Avail: NTIS

A program to determine the feasibility of using millimeter waves for space communication has been conducted and it has been shown that at 15 and 35 GHz atmospheric attentuation is relatively low except for conditions of heavy clouds and vecipitation. Rain attenuation was measured in Hilo, Hawaii and the following results were obtained: (1) total atmospheric attenuation is moderately low at 15 and 35 GHz for rainfall rates less than 1) mm/hr and zenith angles less than 45 deg. For higher rainfall rates and angles closer to the horizon the attenuation becomes prohibitive, particularly at 35 GHz; (2) total atmospheric attenuation can be accurately calculated from a measurement of apparent sky temperature; and (3) atmospheric attenuations at 15 and 35 GHz are highly correlated. Author

N71-21416# McGill Univ., Montreal (Quebec).
APPLICATION OF WEATHER RADAR DATA TO PROPAGATION QUESTIONS
R. R. Rogers *In* AGARD Tropospheric Radio Wave Propagation, Pt. 1 Feb. 1971 11 p refs Supported by Can. Dept. of Commun. (See N71-21409 10-07)
Avail: NTIS

The weather radar facility instrument provides a real time display of the 10GHz attenuation due to rainalong the radar line of sight. Three months' data from two summers have been analyzed to given attenuation statistics for application to communications over terrestrial and satellite microwave links. Preliminary results are presented for the azimuth extent, duration, and frequency of occurrence of attenuations ranging from 5 to 30 GHz at elevation angles between 3 deg and 20 deg. Author

N71-21417# Communications Research Centre, Ottawa (Ontario).
SIMULTANEOUS MEASUREMENTS OF PRECIPITATION ATTENUATION AND RADAR REFLECTIVITY AT CENTIMETRE WAVELENGTHS
K. S. McCormick *In* AGARD Tropospheric Radio Wave Propagation, Pt. 1 Feb. 1971 12 p refs (See N71-21409 10-07)
Avail: NTIS

Measurements have been made of precipitation attenuation along slant paths through the troposphere. Beacons at 4, 8 and 15 GHz were carried by an aircraft which flew in circular paths around a receiving antenna, with elevation angles to the aircraft for different flights between 3 and 20 degrees. Simultaneous measurements of backscatter from precipitation along the propagation path were made using a 2.9 GH weather radar. The radar data have been used to calculate values of the path attenuation, using empirical relations to relate attenuation to reflectivity factor. Data were obtained for situations including moderate widespread rain, an intense shower, rain cells which apparently contained hail in their cores, and situations in which a distinct melting layer was present. On the basis of the measured data, it is concluded that the radar can be used to calculate values of path attenuation that give satisfactory agreement with the observed values, provided that hail or a melting layer is not intercepted by the radar beam. Author

N71-21418# Texas Univ., Austin. Electrical Engineering Research Lab.
COMPARISON OF 15 GHz PROPAGATION DATA FROM THE ATS 5 SATELLITE WITH GROUND BASED RADIO AND METEOROLOGICAL DATA
A. W. Straiton and B. M. Fannin *In* AGARD Tropospheric Radio Wave Propagation, Pt. 1 Feb. 1971 10 p refs (See N71-21409 10-07)
Avail: NTIS

15 GHz signals transmitted from the ATS-5 satellite and related ground based observations are discussed. The purpose of the experiments is to determine the reliability and predictability of communication from space at frequencies higher than presently used. The ATS-5 satellite was put in synchronous orbit at 108 deg West longitude. Failure in one of the positioning jets prevented stabilization with a resulting rotation 76 cycles per minute. However, it was possible to determine significant information on the transmission characteristics of the atmosphere. Various ancillary data were taken including wind speed and direction, temperature, rain rate and distribution, sky temperature and surface radio wave attenuation. Author

N71-21419# Communications Research Centre, Ottawa (Ontario).
MICROWAVE ATTENUATION MEASUREMENTS USING THE ATS 5 SATELLITE
J. I. Strickland and J. W. B. Day *In* AGARD Tropospheric Radio Wave Propagation, Pt. 1 Feb. 1971 7 p refs (See N71-21409 10-07)
Avail: NTIS

The attenuation by precipitation a 15.3 GHz signal is being measured for slant paths of 30 degrees elevation angle using the beacon transmissions of the ATS-5 satellite. The sky temperature at 15.3 GHz along the propagation path is measured simultaneously with a total power radiometer. Predicted attenuations are calculated from measured values of the sky temperature. Backscatter of radiation of 2.9 GHA GHz is measured with a collocated S-band radar. Values of mean radar reflectivity are calculated and path attenuations at 15.3 GHz derived. Generally good agreement between radiometer predicted, radar predicted, and directly measured attenuations is obtained. Author

N71-21420# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Abteilung Weltraumphysik.
INFLUENCE OF THE TROPOSPHERE ON LOW INCIDENT SATELLITE SIGNALS IN THE RANGE OF WAVELENGTH 15 TO 2 m
G. K. Hartmann *In* AGARD Tropospheric Radio Wave Propagation, Pt. 1 Feb. 1971 11 p (See N71-21409 10-07)
Avail: NTIS

The amplitude of radio signals from the beacon satellite Explorer 22 has been recorded since November 1964 for the purpose of obtaining the ionospheric electron content from the Faraday effect. On a considerable number of occasions when the satellite was at low elevation angles, sudden increases in signal amplitude were observed. Detailed investigations show that these enhancements are the results of diffractions of the radio waves by structuers within the troposphere. These effects were observed on 20 MHz, 40 MHz, 41 MHz and 136 MHz. Detailed investigations of Explorer 22 records from 1965-1968 revealed that about 6% of all recordings showed these tropospheric effects. Very recent observations with signals from the geostationary satellite ATS 3 on 137.350 MHz and 412.05 MHz clearly demonstrated that similar effects were detectable. Author

N71-21421# Forschungsinstitut fuer Hochfrequenzphysik, Bonn (West Germany).
TROPOSPHERIC PATH PARAMETERS WITH MULTIPLE ACCESS SYSTEMS IN SPACE COMMUNICATIONS
H. J. Albrecht and R. Makaruschka *In* AGARD Tropospheric Radio Wave Propagation, Pat. 1 Feb. 1971 19 p Sponsored by Min. of Defence, Federal Rep. of Ger. (See N71-21409 10-07)
Avail: NTIS

Design aspects for optimized multiple access systems with reference to variable tropospheric conditions are discussed. Particular mention is made of frequency division multiple access (FDMA), time division multiple access (TDMA), and code division multiple access (DCMA). The tropospheric parameters which are likely to influence the choice of the multiple access systems, as, for instance, turbulence with variable turbulence characteristics, layer-like occurrences in the lower and upper troposphere, and effects of ground inversion layers are described. In each case, the dependence of the tropospheric path links upon the effective elevation angle of operation is considered a major criterion. Author

N71-21422# Air Force Systems Command, Wright-Patterson AFB, Ohio. Avionics Lab.
THE EFFECT OF THE PROPAGATION MEDIUM ON HIGH DATA RATE TRANSMISSIONS AT LOW ELEVATION ANGLES
W. T. Hunt *In* AGARD Tropospheric Radio Wave Propagation, Pt. 1 Feb. 1971 9 p refs (See N71-21409 10-07)
Avail: NTIS

A radio wave passing through a turbulent propagation medium such as the troposphere, suffers distortions which are equivalent to the generation of new signals or propagation medium noise. The desired signal will be modulated, causing unwanted noise and erroneous interpretation of the recieved signals. This problem increases greatly when one or both terminals are moving rapidly through turbulent media. The problem is greatly accentuated at elevation angles of less than 10 degrees, because of the longer path the signal has to travel through the troposphere and because of multipath effects. Aircraft-to-ground tests at S-band frequencies utilizing a 250,000 bit/sec rate and satellite-to-ground tests at X-band frequencies have been conducted at bandwidths of 8 MHz. These tests are described and some of the results are summarized. Author

N71-21423# Radio and Space Research Station, Slough (England).
EFFECTS OF TROPOSPHERIC LAYER STRUCTURE ON PROPAGATION AND SIGNAL DISTORTION
J. A. Lane *In* AGARD Tropospheric Radio Wave Propagation, Pt.

1 Feb. 1971 14 p refs (See N71-21409 10-07)
Avail: NTIS

The nature of elevated layers of large vertical gradient of refractivity in the troposphere is discussed. In addition to earlier observations with refractometers on aircraft, much important information has been obtained with balloon-borne instruments, optical radar (lidar), acoustic radar, and centimeter radar of high resolution. Some degree of stratification in the first few kilimeters above ground is now known to be relatively common, but the precise effect of such stratification on signal strength, fading characteristics, Doppler spectrum, available bandwidth, space diversity and gain degradation has been investigated in relatively few investigations. The significance of dynamic stability is discussed and recent experiments of special importance are reviewed in relation to those results which are especially relevant to the physical nature of layer structure and theories of turbulence. Author

N71-21424# Environmental Science Services Administration, Boulder, Colo.

REFLECTIONS FROM ELEVATED LAYERS IN TRANSHORIZON RADIO PROPAGATION

Gordon D. Thayer *In* AGARD Tropospheric Radio Wave Propagation, Pt. 1 Feb. 1971 14 p refs (See N71-21409 10-07)
Avail: NTIS

Computations of the power reflection coefficient R for some tropospheric elevated layers observed with radio refractometers show that the mean R varies; fluctuation values from the chi to the minus 1 power dependence with standard deviations of from 3 to 14 db depend on the degree of smoothness assumed in predicting a scatter in the wavelength dependence as obtained from scaled frequency-diversity transhorizon radio experiments. The mean wavelength dependence derived from the chi to the minus 1 power model and the exact value depend on assumptions about the horizontal dimensions of individual layers compared with the size of the Fresnel zones. Published results indicate that the atmosphere consists of a mixture of large and medium layers. The randomness of the chi-dependence of real tropospheric layers makes it difficult to separate layer and turbulence mechanisms in radio propagation experiments. Author

N71-21425# Saarland Univ., Saarbrucken (West Germany). Inst. for Applied Physics and Electrotechnology.

PROPAGATION OF AN ELECTROMAGNETIC PULSE IN A DUCT BETWEEN GROUND AND ATMOSPHERIC LAYER

K. J. Langenberg *In* AGARD Tropospheric Radio Wave Propagation, Pt. 1 Feb. 1971 13 p refs (See N71-21409 10-07)
Avail: NTIS

The influence exerted onto an electromagnetic pulse by an atmospheric surface duct is studied based on a duct model consisting of a layer of relative premittivity overlying an infinitely conducting plane earth. At the height h this permittivity decreases discontinuously to the value epsilon sub 2. The source of the electromagnetic field is assumed to be a vertical magnetic dipole above the surface of the earth with arbitrary time varying moment. The application of a Hankel transform of zero order leads to an integral representation of the Fitzgerald vector in the imaging space of a Fourier transform describing the received signal at some point in a cylindrical coordinate system. The Fourier reverse transform of the modal expansion is calculated approximately by the method of stationary phase giving a clear picture of the characteristics of an incoming signal with the aid of the group velocity concept. Author

N71-21426# Radio and Space Research Station, Slough (England).

TRANSHORIZON PROPAGATION STUDIES AT VHF AND UHF

M. P. M. Hall *In* AGARD Tropospheric Radio Wave Propagation, Pt.1 Feb. 1971 10 p refs (See N71-21409 10-07)
Avail: NTIS

Measurements made to examine propagation modes producing considerable signal enhancement over the long-term median on a VHF transhorizon path are discussed. Meteorological measurements were made near the path center using a specially made radiosonde beneath a tethered balloon. Two examples are considered. On one the propagation mode changed twice within three hours; on the other the propagation mode remained constant despite a steady drop in signal of 10 dB. Author

N71-21427# Hamburg Univ. (West Germany). Meteorological Inst.

PROPAGATION, 16 GHz AND 17 GHz, ON A TRANSHORIZON PATH OVER SEA

H. Jeske *In* AGARD Tropospheric Radio Wave Propagation, Pt. 1 Feb. 1971 10 p refs (See N71-21409 10-07)
Avail: NTIS

Transmission measurements were carried out on transhorizon paths over sea at wave lengths of 1.8 cm and 4.4 cm. During the experiments the radio field strengths and the meteorological data for the determination of the propagation properties were recorded simultaneously. The dominating feature of C band propagation over sea is ducting by a permanently existing low level evaporation duct. The theoretical and experimental dependence of field strength on the thickness of this evaporation duct is discussed. The duct mechanism is clearly identified. Only occassionally (in about 15% of time) the stratification of higher layers becomes predominant. Author

N71-21428# Hamburg Univ. (West Germany). Inst. for Radiometeorology.

DUCT INFLUENCES ON LINE OF SIGHT PROPAGATION

H. W. Fruechtenicht *In* AGARD Tropospheric Radio Wave Propagation, Pt. 1 Feb. 1971 9 p (See N71-21409 10-07)
Avail: NTIS

The influence of surface ducts on line-of-sight propagation of electromagnetic waves is investigated by model calculations. The theoretical considerations are based on ray-tracing techniques. A linear, parabolic, and a logarithmic profile as well as a two-layer-model and a three-layer-model are employed to calculate the total field. Obviously only the beam reflected at the surface of the earth gives rise to a concentration of the electromagnetic energy inside a tube-like structure near the ground. The existence of the surface duct, however, is by no means sufficient for the development of the focusing effect; the surface of the earth is necessary as additional reflector. The theoretical dependence of the signal strength on the duct thickness according to a three layer model corresponds with the experiment. Author

N71-21429# Research Inst. of National Defence, Stockholm (Sweden).

BEYOND THE HORIZON PROPAGATION OVER SEA AT 170 AND 5000 MHz

F. Eklund, A. Blomquist, and L. Nilsson *In* AGARD Tropospheric Radio Wave Propagation, Pat. 1 Feb. 1971 6 p (See N71-21409 10-07)
Avail: NTIS

Investigations of anomalous propagation have been made at 170 and 5000 MHz over a sea path in the Baltic area of such a length that the receiving antennas were well beyond the radio horizon. The received signals are separated into the following types: standard atmosphere signals (tropospheric scatter signal), stable, and not stable signals caused by ducting or reflections in elevated layers. A comparison of the occurrence of different signal types as a function of the time of the year is given. The signals at 170 and 5000 MHz are often noncorrelated, which indicates

that the propagation is governed by different mechanisms. The conclusion is drawn that, with regard to propagation forecasting, it is of special importance not only to predict the occurrence of elevated layers but also their effects at different frequencies. Author

N71-21430# Stanford Univ., Calif.
TROPOSPHERIC INFLUENCE UPON DIFFRACTION PATHS
A. T. Waterman, Jr. *In* AGARD Tropospheric Radio Wave Propagation, Pt. 1 Feb. 1971 6 p refs (See N71-21409 10-07)
Avail: NTIS

Two characteristics of diffraction paths are emphasized as criteria for distinguishing them from other propagation paths: the presence of a physical obstacle obstructing the line of sight between transmitter and receiver, and the relatively slow fluctuation rate evident in the received signal. The troposphere affects signal characteristics in a variety of ways, not all of which are distinct and separable. Tropospheric scatter is a competing effect; when conditions are right for it to predominate, the primary result is a marked increase in fading rate. Strongly refracting vertical gradients of refractive index effectively change the geometry of the path, making the apparent obstacle height greater or less, and shifting the regions illuminated by narrow beam antennas. Phase perturbations at the diffracting aperture influence the correlation between spaced antennas, and thus the optimum spacing for diversity reception. Author

N71-21431# Forschungsinstitut fuer Hochfrequenzphysik, Bonn (West Germany).
VHF PROPAGATION MEASUREMENTS ON MIXED DIFFRACTION-SCATTER PATHS
R. Menzel and Kh. Rosenbach *In* AGARD Tropospheric Radio Wave Propagation, Pt. 1 Feb. 1971 10 p refs Sponsored by Min. of Defence, Federal Rep. of Ger. (See N71-21409 10-07)
Avail: NTIS

Variations of diffraction link characteristics are analyzed with respect to changes in relative effects of diffraction and scatter components and due to variable meteorological conditions. A basic signal analysis is undertaken and it is shown that the expected received signal consists of three components: a diffraction, a scatter, and a reflection component. Experimental data discussed deal with two main points; (1) an explanation of the variations of the average received basic signal level of this link; and (2) an interpretation of occasionally occuring fading. The variations of the average received basic level of this mixed link correlate very closely with the variations of the ground temperature. A seasonal and diurnal effect was observed. A good correlation was found between fading periods, the presence of upper or lower inversion layers, and special wind characteristics as defined by direction and velocity. Author

N71-21432# Saarland Univ., Saarbrucken (West Germany). Inst. for Applied Physics and Electrotechnology.
METHOD OF CALCULATING PROPAGATION OF ELECTROMAGNETIC WAVES IN AN INHOMOGENEOUS ATMOSPHERE ABOVE ROUGH GROUND
Klaus-Dieter Becker *In* AGARD Tropospheric Radio Wave Propagation, Pt. 1 Feb. 1971 10 p (See N71-21409 10-07)
Avail: NTIS

It is shown, that the perturbation method for calculating the influence of roughness of the earth on the propagation of electromagnetic waves is also applicable in the case of an inhomogeneous atmosphere. The method itself is described in two steps: The solutions of Maxwell's equations for an inhomogeneous atmosphere are found by a method which reduces the problem to the solution of two modified wave equations. These can be formally solved by the two-sided two dimensional Fourier transform. The transition conditions on the rough surface of the earth are fulfilled by making a Taylor's expansion for the total field in the rough surface and by taking in account the perturbation formulation for the total electromagnetic field. The new transition conditions and the radiation condition of Sommerfeld and Muller lead to a system of integral equations for the reflection and transmission coefficients of the disturbed electromagnetic field. Author

N71-21433# Centre National d'Etudes des Telecommunications, Issy-les-Moulineaux (France). Dept. EST/EFT.
INTERMODULATION AND FADING DURATION DUE TO PROPAGATION (LONG WIDEBAND COMMUNICATION) [INTERMODULATION ET DUREE DES EVANOUISSEMENTS DUS A LA PROPAGATION (LIAISON LONGUE ET A LARGE BANDE)]
G. H. Lefrancois *In* AGARD Tropospheric Radio Wave Propagation, Pt. 1 Feb. 1971 17 p ref In FRENCH (See N71-21409 10-07)
(ONET-NT-EST/APH/1) Avail: NTIS

The intermodulation noise during propagation of a combination hertzian beam at 6 GHz and a wideband (32 MHz) is evaluated statistically for duration and depth of fading in order to clarify the effects of these phenomena in analog and numerical modulation. Obtained measurements show that intermodulation noise at median power becomes negligible before one minute because of the developing thermal noise as soon as fading passes beyond 10 db; therefore the noise is not detected during qualitative analysis of the combined propagation. Duration of fading follows the normal logarithmic quadradic law independent of depth. Transl. by G.G.

N71-21459*+ Radiation, Inc., Melbourne, Fla.
DESIGN AND DEVELOPMENT STUDY FOR A SPACE BASE MULTIPLE SIGNAL MODEM (SMDS), VOLUME 2 Final Report
Dec. 1970 192 p refs
(Contract NAS9-10417)
(NASA-CR-114927) Avail: NTIS CSCL 17B

The technical descriptions and development specifications for modules and subunits required to mechanize the space base telecommunications system are presented. These modules are the mainline amplifier, modulator group, demodulator group, central telephone electronics, central intercom electronics, and digital station. Mathematical analysis of design and circuit development are described. N.E.N.

N71-21465*# Martin Marietta Corp., Denver, Colo.
STUDY OF POTENTIAL APPLICATIONS OF DIGITAL TECHNIQUES TO THE APOLLO UNIFIED S-BAND COMMUNICATIONS SYSTEM, PHASE 2 Final Report
Nov. 1970 132 p refs
(Contract NAS9-9852)
(NASA-CR-114921; MCR-70-419) Avail: NTIS CSCL 17B

Digital data processing and error correcting code techniques and how they could be applied to the Apollo unified S-band communication system are discussed. An iterative process for increasing performance was discovered. This new technique developed into an independent decoding algorithm of great promise for space communication. The new algorithm is described and the analysis that predicts its performance in certain limiting cases and results of simulation on a general purpose computer are presented. The results of computer simulation indicate that, for a rate denomination of 3, it outperforms sequential decoding. It is also self-starting and, unlike sequential decoding, it does not require periodic interruption of the data stream to insert a known sequence for recovery after a failure. Large constraint lengths are feasible (958 was used in the simulation), and therefore the system is resistant to fading. A small breadboard decoder designed and built to demonstrate the feasibility of operation at 11 Mb/s, is described. Author

N71-21476* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CORRELATION FUNCTION APPARATUS Patent
Richard M. Goldstein, inventor (to NASA) Issued 19 Dec. 1967 (Filed 9 Apr. 1963) 7 p Cl. 235-181 Sponsored by NASA (NASA-Case-XNP-00746; US-Patent-3,359,409; US-Patent-Appl-SN-271824) Avail: US Patent Office CSCL 12A

An electronic circuitry is described which develops a correlation function continuously as the signal or signals are received, and completely develops the function during the receiving period. The method considers, at an appropriate sampling rate, only the algebraic sign of the signal rather than the amplitude. It then sequentially applies binary signals representative of the sign to a delay line, consisting of many multiples of basic delays. Many binary signals, each with a different delay, are simultaneously made available to permit products of signals separated by a time delay to be continuous. N.E.N.

N71-21645# Joint Publications Research Service, Washington, D.C.
PROTECTION FROM THE EFFECT OF RADIO WAVES
Ye. L. Kulikovskaya 15 Mar. 1971 151 p refs Transl. into ENGLISH of the book 'Zashchita ot Deystviya Radiovoln' Leningrad, Sudostroyeniye, 1970 152 p
(JPRS-52622) Avail: NTIS

The radio hazardous conditions of workers who tune, regulate, test, and operate high frequency and superhigh frequency devices are discussed, with particular regard to shipbuilding and the maritime fleet. Radiation sources, methods of measuring radiation, and possible intensities of irradiation during various types of operation and its biological effects are considered. Protective measures are given against the radiation effects from HF industrial heating devices, and radio and radar equipment during repair and operation. N.E.N.

N71-21648# General Instrument Corp., Hicksville, N.Y. Electronic Systems Div.
RADAR SET AN/PPS-17(XN-1) FAILURE FREE DEVELOPMENT PROGRAM Interim Development Report, 1-31 Oct. 1970
Walter Seidman and Al Zecca 31 Oct. 1970 21 p
(Contract N00039-70-C-3501)
(AD-717080; ESD-1158-IR-9) Avail: NTIS CSCL 17/9

The report covers the period of October 1 to October 31. Phase 2 of the contract, which consists of designing, manufacturing and testing of 20 High Reliability Radar AN/PPS-17(XN-1), is proceeding satisfactorily. A major milestone was successfully achieved in the complete assembly, debugging and testing of the prototype R/T assembly. GRA

N71-21750# Brookhaven National Lab., Upton, N.Y.
INTERNAL LOGIC MANUAL FOR THE PROGRAMMED COMMUNICATIONS CONTROLLER (PCC)
Joan Felberbaum [1970] 115 p Sponsored by AEC
(BNL-15437) Avail: NTIS

Internal logic for the programmed communications controller is presented and is designed to connect sixteen teletypewriter terminals to the multiple spectrometer control system. The Varian 620i and XDS-920 computers were used for the time sharing runs. The program and routine/subroutine logic is described, as well as system's design and construction. J.A.M.

N71-21756# Sandia Corp., Albuquerque, N.Mex.
ANALYSIS OF DSB/FM TELEMETRY SYSTEM ERRORS
Kenneth M. Uglow Dec. 1970 112 p refs Sponsored by AEC
(SC-CR-70-6092) Avail: NTIS

The result of a study of errors in two methods of radio telemetry using suppressed-carrier double-sideband subcarrier channels on an FM radio carrier, including the errors caused by magnetic tape recording and reproduction of the received signal are given. The two methods are the independent subcarrier method and the harmonic subcarrier method currently under consideration for standardization. The report deals with errors caused by the transmission and tape recording links. The discussion is devoted to the selection of analytical and empirical models for the disturbances caused by the transmission and recording links, including the presentation of experimental data. Error transfer relationships are included for determining the error on the data channel output due to the disturbances. These relationships and the error cause models are then combined in tables of calculated values for many different combinations of recording methods,receiver carrier/noise ratios, channel locations, and subcarrier methods. Author

N71-21798# Naval Research Lab., Washington, D.C.
SYMPOSIUM ON LONG WAVE PROPAGATION: AGENDA AND ABSTRACTS
Jan. 1971 31 p Conf. held at Menlo Park, Calif., 19-21 Jan. 1971
(AD-716739; NRL-MR-2202) Avil: NTIS CSCL 20/14

Abstracts of research projects presented at the symposium are given and include the following: (1) correction terms in the propagation for VLF and ELF, (2) exact solutions of some waveguide discontinuity problems, (3) results of a numerical mode conversion study at VLF, (4) VLF day to nighttime discontinuities in the anisotropic terrestrial waveguide, (5) dependence of VLF mode conversion at terminator on its angle with direction of wave propagation, (6) synthesis of normal and disturbed ionospheric models, (7) the effects of ions on long path VLF propagation for ambient nighttime conditions, (8) some possible effects of the propagation medium upon ELF communications, (9) differences between pulse trains of ELF atmospherics at widely separated locations, (10) effects of X-ray stars on VLF signal phase, (11) solar X-ray effects on VLF signal phase and amplitude, (12) diurnal phase variation at 10.2 KHz, (13) statistical multimode VLF field strength predictions, and (14) time histories of electron densities deduced from VLF sounding of the D-region. D.L.G.

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N71-20622*# System Development Corp., Huntsville, Ala.
EXPERIMENTAL SIMULATION SOFTWARE (FPE 5.1)
15 Mar. 1971 85 p
(Contract NAS8-25471)
(NASA-CR-103076; TM-(L)-HU-033/003/00) Avail: NTIS CSCL 09B

The software required to automate the acquisition, analysis, and display of the prime data for the X-ray polarimeter experiment is described. Software to generate simulated input to test the experiment software is also covered. The study indicates that real time, on-board processing of primary experiment data can be beneficial not only in reducing the amount of data that must be transmitted, but also in reducing the reaction time to modify or update the experiment sequence due to unexpected events of experiment results. Author

N71-20623*# System Development Corp., Huntsville, Ala.
EXPERIMENT SUPPORT SOFTWARE TECHNIQUES ANALYSIS (FPE 5.3A)
15 Mar. 1971 91 p refs
(Contract NAS8-25471)
(NASA-CR-103077; TM-(L)-HU-033/004/00) Avail: NTIS CSCL 09B

The results of a study of the image data processing techniques that may be required on board a manned space station to support an X-ray imaging solar telescope are presented. The various techniques required are described and flow charts of their basic operation are presented. Each technique is evaluated with respect to its usefulness in support of the experiment and its requirements for computer run time. The hardware implications of providing image processing facilities for the experiment in space are described. Author

N71-20624*# Sperry Rand Corp., Huntsville, Ala. Space Support Div.

GENERAL PURPOSE SIMULATOR SYSTEM STUDY

J. Scoggins and J. Taras 4 Nov. 1970 328 p refs

(Contract NAS8-25608)

(NASA-CR-103078; SP-209-0339-3) Avail: NTIS HC $6.00/MF $0.95 CSCL 09B

An evaluation of the DEE-6 Simulator System and modification for shuttle applications are presented. The philosophy behind the Shuttle data management system and various schemes for simulating the major subsystems aboard the booster and orbiter are discussed. The proven simulation language MARDIGS is described, and modifications in the software and hardware to upgrade the digital system to an effective simulator are given. These include the following: making all equations resident in core memory, providing a separate processor(s) for the solution of analog equations, providing external clocks and eliminating cycle stealing by the processor for updating internal memory locations, providing hardware floating point operations to eliminate time consuming subroutines, providing a single Boolean status variable for each analog segment of an equation, and making selectable the variables to be recorded on magnetic tape. The subsystem simulator is capable of accepting and sending discrete signals formatted for data bus transmission, and the analog equations are solved within a millisecond time frame providing analog signals of proper response time for shuttle simulation. Author

N71-20678# Joint Publications Research Service, Washington, D.C.

PROBLEMS IN SEMANTIC COMPARISON OF NATURAL AND MATHEMATICAL LOGIC LANGUAGES

Ye. V. Paducheva 15 Mar. 1971 27 p refs Transl. into ENGLISH from Issled. Logicheskikh Sistem (Moscow), 1970 p 86–112

(JPRS-52621) Avail: NTIS

One variant of applied predicate calculus is considered: an information logic language for elementary geometry. The language permits the recording of basic geometric facts, and in principle permits the realization of logic processing of the recorded information. A description of the syntax and lexicon of the language is given. Author

N71-20695# California Univ., La Jolla. Dept. of the Aerospace and Mechanical Engineering Sciences.

A KOITER-TYPE METHOD FOR FINITE ELEMENT ANALYSIS OF NONLINEAR STRUCTURAL BEHAVIOR. VOLUME 2: USER'S MANUAL FOR PROGRAM BEHAVE Final Report, 17 Oct. 1969–17 Oct. 1970

R. T. Haftka, R. H. Mallett, and W. Nachbar Wright-Patterson AFB, Ohio AFFDL Nov. 1970 108 p

(Contract F33615-69-C-1899)

(AD-717181; AFFDL-TR-70-130-Vol-2) Avail: NTIS CSCL 20/11

The report contains the description of the FORTRAN language program BEHAVE that was used to obtain the numerical results for the example problems that are presented and discussed in Volume I. Program BEHAVE is designed for the analysis of the structural behavior of rigidly jointed planar frames. The finite element used for the analysis is the stability element described in Section IV of Volume I. BEHAVE can perform a linear stability analysis, a Modified Structure method analysis, a direct nonlinear analysis, and combination of the above analyses. This volume consists of three parts: a Users guide; a programmers manual; and a listing of the program and subroutines. Author (GRA)

N71-20817# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

APPLICATION OF AN ANALOG-DIGITAL COMPLEX FOR OPTIMIZING AN AUTOMATIC CONTROL SYSTEM

V. S. Ter-Mkaitarov et al 28 Sep. 1970 11 p refs Transl. into ENGLISH from Analogovaya i Analogo-Tsifrovaya Vychislitelnaya Tekhn., Sb. Statei (USSR), no. 2, 1968 p 22–27

(AD-717038; FTD-MT-24-133-70) Avail: NTIS CSCL 9/2

An analog-digital control system based on the Minsk-1 and MPT-9-3 computers is described. The system was developed at the Perm Polytechnic Institute, and is designed to automatically control the accuracy of a repetitive output within given accuracy limits. In addition to the computers, the system has a code-to-voltage converter with eight commutator outputs; a voltage-to-code converter with 32 commutator outputs; eight code-to-resistance converters; and five relay channels. The average maximum sampling rate is 100/sec; conversion accuracy is 0.4 percent of maximum value. Corrective action is determined both by error magnitude and its first derivative. A system block diagram and an algorithm diagram are given. The system is said to be applicable to a wide variety of automatic control problems in which the task can be modeled on the MPT-9-3 computer. Author (GRA)

N71-20822# Norwegian Computing Center, Oslo (Norway).

A USER-ORIENTED DATA LANGUAGE [ET BRUKERORIENTERT DATASPROG]

Sverre Spurkland Apr. 1969 28 p In NORWEGIAN; ENGLISH summary Sponsored by Min. for Finance and Planning

Avail: NTIS

A simple user-oriented language has been constructed for description of relatively simple data structures and specification of operations. Author (ESRO)

N71-20843# National Bureau of Standards, Washington, D.C. Statistical Engineering Lab.

TEST PROBLEMS AND RESULTS FOR OMNITAB 2

Ruth N. Varner and Sally T. Peavy Dec. 1970 194 p refs

(NBS-TN-551) Avail: SOD $1.50 Catalog No. C-13.L16:551

A set of fifty two test problems and results for the OMNITAB 2 system is provided to assist individuals in checking the implementation of the OMNITAB 2 program on their particular computer. The general user will also find these descriptive examples instructive in the use of OMNITAB commands. Author

N71-20844# National Bureau of Standards, Washington. Statistical Engineering Lab.

SOURCE LISTING OF OMNITAB 2 PROGRAM

Sally T. Peavy, Ruth N. Varner, and David Hogben Dec. 1970 374 p refs

(NBS-Spec-Publ-339) Avail: SOD $4.75 Catalog No. C-13.10:339

OMNITAB 2 is a general purpose interpretive computing system designed to allow a nonprogrammer to use a high speed computer easily, accurately and effectively. The system permits the user to perform arithmetic operations including complex arithmetic, trigonometric calculations, miscellaneous function calculations, statistical analysis, Bessel function calculations, and operations on matrices and arrays. The OMNITAB 2 system contains 177 subprograms written in the ANSI FORTRAN language. Every effort was made to make the system transportable. This publication contains a complete listing of all these subprograms. The listing is preceded by a brief introduction which describes the programming

techniques used; the use of system library functions; and the subprograms used to control the flow of operations in the OMNITAB system. Author

N71-20901# Naval Research Lab., Washington, D.C.
DATA ACQUISITION SYSTEM FOR THE ELECTRON LINAC AND SCIENTIFIC PROGRAM NOTES Progress Report
Feb. 1971 44 p refs
Avail: NTIS

A 4,000,000-channel data acquisition system is used on-line in experiments performed with the 60-MeV electron linear accelerator. The primary application of the system involves the study of neutroncapture gamma rays. In one experimental setup a Ge(Li) detector, with an active volume of 48cc, is employed for high resolution; in another setup four NaI detectors, used in a coincidence arrangement, are placed at 90 deg intervals around the target. In both experiments time-of-flight methods are used to record the neutron energy. The software for these experiments is complete in the sense that data can be stored and retrieved under program control. Author

N71-21042* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SYSTEM FOR RECORDING AND REPRODUCING PULSE CODE MODULATED DATA Patent
Pleasant T. Cole, inventor (to NASA) Issued 20 Jun. 1967 (Filed 10 May 1963) 8 p Cl. 340-174.1
(NASA-Case-XGS-01021; US-Patent-3,327,298; US-Patent-Appl-SN-279646) Avail: US Patent Office CSCL 09B

A description is given of a magnetic tape pulse code modulation data recording system which can efficiently reconstruct the recorded signal from the waveform obtained from the playback head. It is capable, at the same time, of maintaining a maximum transfer of energy from record to playback. The tape also has a large packing density. Official Gazette of the U.S. Patent Office

N71-21093# Allen Clark Research Centre, Towcester (England).
DATA STORAGE SYSTEMS FOR SATELLITES
J. D. Wilcock, R. E. Oakley, and J. Fairholme Jan. 1971 59 p refs
(Contract ESTEC-1108-70-HP)
Copyright. Avail: NTIS: Plessey Co Ltd.

The state-of-the-art in semiconductor volatile storage, semiconductor nonvolatile storage, and magnetic bubble storage is considered in the context of the requirements of the proposed European Meteorological Operational Satellite or similar space vehicles . A semiconductor nonvolatile storage system has been considered in detail and the cost and time scale for fabricating one prototype and two fully tested flight models has been estimated. Tentative designs for data storage systems on the remaining technologies have given mass, volume, weight, and time scale figures for comparison. Author (ESRO)

N71-21143# Ecole Nationale Superieure de Mecanique, Nantes (France). Lab. de Chimie Physique Servomecanismes.
DESIGN STUDY OF A DIGITAL COUNTER [ETUDE DE LA REALISATION D'UN COMPTEUR NUMERIQUE]
J. Paillier, R. Pointeau, and R. Mezencev *In its* Ann. of Mech. Semiann. Rept., 1969 p 235-255 refs In FRENCH (See N71-21133 10-32)
Avail: NTIS

Boolean theory is reviewed and applied to counting circuits. The design of a twelve position counter is explained with the help of Karnaugh tables in both the synchronous and the asynchronous modes. ESRO

N71-21233 Pennsylvania Univ., Philadelphia.
THE DESIGN AND ANALYSIS OF A READ-ONLY GROOVED-FERRITE MEMORY
Leesui Wu (Ph.D. Thesis) 1969 238 p
Avail: Univ. Microfilms: HC $10.80/Microfilm $3.00 Order No. 70-7867

A unique, low-cost, and very high-speed Read-Only Grooved-Ferrite Memory has been conceived, designed, constructed, and tested. The memory employs the batch fabrication technique, and it is essentially an integrated 1:1 transformer array with oper-flux structure. The memory is simply constructed from a magnetically soft ferrite sheet with two sets of orthogonal grooves, and batch-fabricated wiring patterns which are embedded inside the grooves. The memory therefore consists solely of a rugged ferrite slab and copper conductors on mylar insulation to give a configuration of extreme stability and reliability. An extensive theoretical analysis pertaining to the memory characteristics, design optimization, and engineering approximation, implemented by practical system description and experimental results is presented. In conclusion, this unique read-only memory demonstrates high performance characteristics which can be fully exploited in the development of very high-speed computer systems. It shows a compatibility between speed, reliability, and cost that is not easily obtained by other techniques. Dissert. Abstr.

N71-21237# Commerce Dept., Washington, D.C. Office of the Secretary.
COMMENTS ON THE COMPUTER REVOLUTION
Myron Tribus 25 Jun. 1970 6 p Presented at the Inst. de la Vie Conf. "Man and Computer", Bordeaux, 25 Jun. 1970
Avail: Issuing Activity

The problems and advantages caused by the computer revolution are discussed. Particular attention is given to economics, computer uses, and time saving aspects for labor. Author

N71-21240 National Lending Library for Science and Technology, Boston Spa (England).
DIODE AND TRANSISTOR MODELS FOR PURPOSES OF COMPUTER AIDED DESIGN
K. Tarnay et al 4 May 1970 14 p refs Transl. into ENGLISH from Meres Automat. (Hungary), v. 17, no. 4, 1969 p 130-135
(NLL-Trans-2646-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The usefulness of computer aided circuit analysis methods and the possibility of circuit design dependence on the models of semiconductor devices in the circuit is discussed. General questions of the models are surveyed, and the models of devices occuring frequently in practice are also discussed. Author

N71-21294# California Univ., Livermore. Lawrence Radiation Lab.
EXPERIMENTAL RESULTS ON PHASE LOCKED LOOPS WITH ADDED NONLINEARITIES
L. L. Cleland 4 May 1970 5 p refs Presented at the UMR-Merin J. Kelly Commun. Conf., Rolla, Mo. 5-7 Oct. 1970 Submitted for publication Sponsored by AEC
(UCRL-72390; CONF-701024-1) Avail: NTIS

The improvement of signal performance of low order phase-locked loops by inserting nonlinearities in the loop filter is discussed. System improvement with respect to lock range, phase linearity, and rate range is demonstrated. Experimental results indicate that the modified systems also yield improved threshold properties. NSA

N71-21305*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A PREPROCESSOR FOR A REAL TIME DIGITAL COMPUTER

Richard Lee Bulle (M.S. Thesis – Tulsa Univ.) Feb. 1971 91 p refs
(NASA-TM-X-67018) Avail: NTIS CSCL 09B

A real time digital simulation program (SUPERVISOR) was written to interface between a FORTRAN simulation program and the real time system. It provides real time input/output control, timing and synchronization, communication, control, and other system functions unique to real time operations. SUPERVISOR was written as a series of interdependent subroutines that are loaded with each real time program. This provides option selectivity of system features. The objective was to develop a real time digital preprocessor that would minimize the programming involved in writing a real time simulation by providing a meta language to FORTRAN. Author

N71-21332 National Lending Library for Science and Technology, Boston Spa (England).
OPTIMUM NONREDUNDANT CODES IN RESPECT OF THE MEAN LINEAR ERROR ARISING IN THE TRANSMISSION OF INFORMATION IN A SYMMETRICAL CHANNEL WITHOUT MEMORY [OPTIMALNYE BEZYZBYTOCHNYE KODY OTNOSITELNO SREDNEI LINEINOI OSHIBKI, VOZNIKAYUSHCHEI PRI PEREDACHE SOOBSHCHENII V SIMMETRICHNOM KAVALE BEZ PAMYATI]
A. V. Krushevskii Sep. 1970 7 p ref Transl. into ENGLISH from Kibernetika i Tekhnika Vychislenii (Kiev), 1964 p 52–57
(NLL-RTS-6037) Avail: Natl. Lending Library, Boston Spa Engl.: 14s; 2 NLL photocopy coupons

The optimum nature of a simple binary nonredundant code is proved for certain assumptions. Independent random samples of information A1,A2,...,An are assumed to be transmitted along asymmetrical communications channel without memory, with respective probabilities p1,p2,...,pn. A binary nonredundant code U is used for the information transmission, having m digits and n = 2 to the mth code combinations. The information is encoded according to the rule: The ith code combination of the code U(i = 1,2,...,n) corresponds to the item Ai. Decoding is the reverse. Noise effects and mean decoding errors are considered. It is shown that there are at least m! optimum codes. N.E.N.

N71-21463* + General Electric Co., Syracuse, N.Y. Electronics Lab.
EXPANSION OF INPUT CAPABILITY FOR ELECTRONIC SCENE GENERATOR, INSTRUCTION MANUAL Final Report
Jan. 1971 157 p
(Contract NAS9-11065)
(NASA-CR-114923) Avail: NTIS CSCL 09B

The Input Expansion Unit is a self-powered, multi-channel digital data buffer designed to expand input capability through the Input Interface Unit (IIU) of the Electronic Scene Generator (ESG), an array of visual simulation hardware. The Input Expansion Unit (IEU) and modifications made to the operating software of the ESG R520 computer in order to adapt the ESG for use with the IEU are described. Also described are certain other modifications made to the operating software at the time of IEU installation. Author

N71-21488# Inductive Inference, Inc., New York.
AN ADAPTIVE LINGUISTIC MODEL FOR PATTERN REPRESENTATION AND RECOGNITION. DIRECT PRODUCTS OF RELATIONAL SYSTEMS. NOTES ON A COMBINATIONAL STRATEGY FOR ENUMERATION PROBLEMS Final Report
David Rothenberg and Erik Ellentuck 1 Jan. 1971 251 p refs
(Contract F44620-70-C-0060)
(AD-716856; AFOSR-70-2927TR) Avail: NTIS CSCL 9/4

An adaptive pattern representation and recognition system for application to mechanized interpretation of pictorial data from aerial reconnaissance photographs is described. This system differs from conventional pattern recognition systems in that: It generates its own features. These features are generated in a decidable subject of the predicate calculus from which they are translated into computer programs. The formulae which define features are generated using quantifiers and logical connectives from a set of atomic predicates which correspond to information about the metric on the sampled input picture. The recognition procedure selects sub-regions of input pictures and identifies them (i.e. scene analysis). It has provision for an unusual amount of interaction with the trainer to accelerate convergence. The relation between the syntax (formula structure) and semantics (the classes of geometrical figures which satisfy these formulae) is well understood and utilized for rapid convergence. Other papers included extend the system and treat a class of combinatorial problems. Author (GRA)

N71-21500*# Tennessee Univ., Tullahoma. Space Inst.
DEVELOPMENT OF OPTICAL DATA PROCESSING TECHNIQUES APPLICABLE TO DETECTION AND STUDY OF METEOR TRAILS
T. H. Gee, C. W. Allen, and S. M. Amin Dec. 1970 102 p refs
(Contract NAS8-24393)
(NASA-CR-61341) Avail: NTIS CSCL 09B

An investigation has been conducted which was directed towards development of coherent optical data processing techniques applicable to detection of meteor trails and subsequent study of their properties. The coherent optical matched filter was chosen for implementation of such a system. The matched filter was studied with regard to its selectivity and output light distribution as a function of the bandpass characteristics of the filter. Exposure and processing of photographic film, the matched filter recording medium, were experimentally studied to determine the important parameters affecting filter operation. This included addition of a bleaching step to the film processing procedure for improved filter diffraction efficiency. Various bandpass conditions were experimentally established by varying the exposure of the film to the signal component during filter formation. Experiments were conducted relevant to meteor trail detection, and rejection of star images, using a modified closed circuit television system to provide an output plane detector and readout device. Results of these efforts led to specifications and design criteria for an optical data processing system for meteor trail detection and study. Author

N71-21544*# Michigan Univ., Ann Arbor. High Altitude Engineering Lab.
REDUCTION AND ANALYSIS OF DATA FROM OGO-4 EXPERIMENT 15 Final Report, 1 Nov. 1969 – 30 Nov. 1970
R. J. Leite, C. J. Mason, and J. Spencer Jan. 1971 19 p refs
(Grant NGR-23-005-383; ORA Proj. 033460)
(NASA-CR-117525; Rept-033460-1-F) Avail: NTIS CSCL 09B

The procedures used to process the atmospheric composition data obtained through the use of a sweeping quadrupole mass spectrometer on OGO-4 satellite are described. These data were stored in digital form on magnetic tape. Attitude-Orbital data were provided in digital form on magnetic tape also. These two sets of data are correlated in time through date-time comparison. A discussion of conclusions concerning reduction of commutated spectral data and the difficulties associated with interpretation of these data are included. It is shown that use of an electronic computer of appropriate capacity provides the only realistic approach to the processing of commutated spectral data. Author

N71-21561# Computer Symbolic, Inc., Washington, D.C.
A PROGRAMMING SYSTEM FOR THE CONSTRUCTION OF EFFICIENCY-RUNNING HARDWARE-INDEPENDENT GENERAL SYNTAX ANALYSIS PACKAGES Final Technical Report, 15 Aug. 1968 – 14 Nov. 1969
Kenneth B. Krohn and Brian Kritt Griffiss AFB, N.Y. RADC Oct. 1970 263 p

(Contract F30602-69-C-0054)
(AD-716486; RADC-TR-69-453) Avail: NTIS CSCL 9/2

A pilot system has been developed and implemented for use in the construction of efficiently-running hardware independent syntax analysis packages. This system consists of the following: (1) a programming language, the language description language (LDL), which is suited to the construction of general representations of the syntax of programming languages; (2) a compiler for LDL written in the GEMAP language for the GE-645 computer and (3) a program for the determination and implementation of optimizing macrosubstitutions, which collapses any general hardware-independent LDL program into an efficiently-running, consolidated form. Author (GRA)

N71-21657# California Univ., Livermore. Lawrence Radiation Lab.
CYCLE-ALLOCATION DISCIPLINES FOR MULTIACCESS MEMORY SYSTEMS
J. Carver Hill 20 Nov. 1970 5 p refs Presented at IEEE Intern. Conf. on Systems, Networks, and Computers, Oaxtepec, Mexico, 19–21 Jan. 1971 Sponsored by AEC
(UCRL-72648; CONF-710101-1) Avail: NTIS

A multiaccessing memory system should be responsive, efficient, and without a weak central-control logic. These aspects are, to an extent, mutually exclusive if the service discipline imbedded in the accessing structure is first come-first serve, round-robin or strict-priority. An alternate discipline, limited-latency, is developed which exhibits all of the desired characteristics by guaranteeing every access-channel a special fraction of the total number of cycles available. The selection of a set of fractions that will work rests essentially upon a partition of the integers into disjoint residue classes. The disadvantage of the discipline is that its highest-priority channel would not have as high a capacity as that of a strict-priority discipline for a given memory system. Author

N71-21658# Los Alamos Scientific Lab., N.Mex.
CONVERT: AN IBM TO CDS PROGRAM CONVERSION CODE
George C. Hopkins Dec. 1970 9 p refs
(Contract W-7405-eng-36)
(LA-4555) Avail: NTIS

CONVERT, written for the CDC 6600; looks for and flags or changes some of the FORTRAN differences in an IBM FORTRAN program in converting it for use with the CDC 6600. Author

N71-21669 National Lending Library For Science and Technology, Boston Spa (England).
THE MEAN LINEAR ERROR FOR A NONREDUNDANT CODE IN AN UNSYMMETRICAL CHANNEL WITHOUT MEMORY [SREDNYAYA LINEINAYA OSHIBKA DLYA BEZYZBYTOCHNOGO KODA V NESIMMETRICHNOM KANALE BEZ PAMYATI]
A. V. Krushevski Aug. 1970 8 p refs Transl. into ENGLISH from the publ. 'Kibernetika i Tekhnikh Vychislenii) Kiev, 1964 p 58–65
(NLL-RTS-6038) Avail: Natl. Lending Library, Boston Spa, Engl.: 16s; 3 NLL photocopy coupons

Results of an error analysis are discussed based on the suppositions that: (1) An independent and equiprobable sequence of data, represented by the numbers 1,2 ....n, is to be transmitted stochastically along a communications channel without memory. (2) Data transmission is in a binary nonredundant code with n code combinations. (3) The channel may be unsymmetrical; that is, under the influence of random noise the code symbol 0 may switch to 1 with probability r sub o, and the symbol 1 to 0 with probability r sub 1. Findings show that in encoding with a code the mean linear error decreases by up to 20 percent. In encoding non-equiprobable communications, the mean linear error can decrease considerably more. E.C.

N71-21673# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
COMPUTER PROGRAMS FOR ADJUSTING SMALL TRIANGULATION NETS [RECHENPROGRAMME FUER DIE AUSGLEICHUNG KLEINER DREIECHSNETZE]
Dieter Ehlert 1970 143 p refs In GERMAN; ENGLISH summary *Its* Ser. B, No. 176
(Rept-120) Avail: NTIS

A program for the adjustment of relatively small networks of triangulations is described here for which numerical examples are given. Prepared as an auxiliary program to the much more elaborate E. D. P. program system for the adjustment of very large networks it carries out check computations and the testing of weighting factors. Networks of triangulatons containing up to 85 new stations can be adjusted with this program by the displacement of coordinates method in which uncorrelated directions, Laplace azimuths and measured distances may be used as input. Provisions are also made in the program for linear conditional equations which may exist between the coordinates of new stations. Author

N71-21743# Sandia Corp., Albuquerque, N.Mex.
REALIZATION OF NEAR TIME OPTIMAL FEEDBACK CONTROLLERS
Anthony F. Veneruso Nov. 1970 173 p refs Sponsored by AEC
(SC-RR-70-544) Avail: NTIS

Research performed on the realization of near-time-optimal feedback controllers for linear, time invariant systems is presented. The realization is based upon the separation of two sets over which a constant control must be applied and which characterize a family of control policies. Author

N71-21809# Stanford Univ., Calif. Dept. of Computer Science.
A VARIABLE CONTROL STRUCTURE MICRO-COMPUTER ARCHITECTURE OR EMULATION VIA AN INSTANTIATION LANGUAGE, APPENDIX 4
Victor R. Lesser Jul. 1970 65 p refs Sponsored in part by NSF
(Contract AT(04-3)-326)
(TID-25623-App-4) Avail: NTIS

A preliminary investigation of the organization of a parallel microcomputer designed to emulate a wide variety of parallel and sequential computers is presented. Microprograms for this processor may be programmed to execute independently of the number of physical processors present, and still take advantage of available processors. This microcomputer allows tailoring of the control structure of an emulator so that it directly emulates (mirrors) the control structure of the computer to be emulated. An emulated control structure is implemented through a tree type data structure which is dynamically generated and manipulated by six primitive (built-in) operators. This control structure is used as a syntactic framework within which particular implementations of control concepts, such as iteration, recursion, co-routines, parallelism, interrupts, etc. can be easily expressed. Author

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N71-20618# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A NEW TECHNIQUE FOR THE DESIGN OF NON-RECURSIVE DIGITAL FILTERS
Edward M. Hofstetter 15 Dec. 1970 15 p refs
(Contract F19628-70-C-0230)
(AD-717163; TN-1970-42; ESD-TR-70-400) Avail: NTIS CSCL 9/5

An algorithm for designing non-recursive frequency-selective digital filters having equal stop-band ripples of specified magnitude is described. There is no known upper limit on the order of the filter that can be designed by this algorithm and filters with orders in the hundreds already have been designed. Author (GRA)

N71-20640# Helsinki Univ. (Finland). Radio Lab.
ON THE PHASE STABILITY OF PARAMETRIC AMPLIFIERS
P. Somervuo and Y. Sirkeinen 1970 18 p refs
(Rept-S-35-1970) Avail: NTIS

A study of the phase behavior of a parametric amplifier with small variations occurring in pumping or varactor biasing is made. Formulas for the phase instability caused by adjacent signals on the amplifier band are also derived. Experimental results obtained in measurements and with the aid of a computer using a more accurate equivalent circuit of the amplifier are also given. Author (ESRO)

N71-20658* Radio Corporation of America, Princeton, N.J.
COLLAPSIBLE REFLECTOR Patent
Robert J. Mason, Patrick T. Scully, and Franklin S. Wazner, inventors (to NASA) Issued 26 Dec. 1967 (Filed 13 Jan. 1965) 7 p Cl. 343-915 Sponsored by NASA
(NASA-Case-XMS-03454; US-Patent-3,360,798; US-Patent-Appl-SN-425363) Avail: US Patent Office CSCL 09E

An automatically erecting parabolic reflector is described which utilizes leaf springs for erection from an original packaged condition. A flexible reflective sheet is stretched across articulated ribs, each of which is foldable at a leaf spring joint near its mid-point and at an end junction where it is joined by leaf spring members at the vertex of the paraboloid to an axial elongate member. The resilient leaf springs bias the ribs to a normally unfolded condition. In its packaged condition, the ribs are folded and held against the axial member by latching tabs, one on each rib near its mid-point, which are releasably engaged with a holding ring affixed to the axial member. The free ends of the ribs are held adjacent the axial member by an encompassing retainer band. By removing the retainer band, the leaf spring connections urge the ribs to unfold whereby the latching tab of each rib is unlatched from the axial member and the reflector assumes its operational configuration. Official Gazette of the U.S. Patent Office

N71-20691# Danish Research Centre for Applied Electronics, Copenhagen.
INSULATION RESISTANCE IN PRINTED CIRCUITS: AN INVESTIGATION OF DIFFERENT TYPES UNDER DIFFERENT CLIMATIC CONDITIONS [ISOLATIONSMODSTAND I PRINTPLADER: EN UNDERSOEGELSE AF EN RAEKKE TYPER OG FABRIKATER UNDER FORSKELLIGE KLIMATISKE FORHOLD]
S. T. Olesen Jul. 1970 40 p In DANISH; ENGLISH summary Sponsored by Sammenslutningen for Palidelighed og Miljoeteknik
(ECR-14) Avail: NTIS

Measurements of insulation resistance on a number of types and manufactures of printed circuit boards are investigated. Boards newly supplied by the manufacturer as well as those exposed to humidity, or placed under conditions of an increased working temperature, were taken as samples. A total of 33 different types of phenol/paper, epoxy/paper, epoxy/glass, polyester/glass, and teflon/glass materials have been collected from various industrial consumers and suppliers. The purpose of the project was to investigate how often in practice lots with insufficiently baked material, and consequently with a poor insulation resistance, would occur. However such lots did not occur, and are probably not as frequent as was assumed. The measurements can be used, however, as a guidance for instrument designers who construct equipment for operation under difficult climatic e.g. tropical, conditions. Author (ESRO)

N71-20705* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD OF COATING CIRCUIT PATHS ON PRINTED CIRCUIT BOARDS WITH SOLDER Patent
Albin E. Wittmann, inventor (to NASA) Issued 19 Dec. 1967 (Filed 10 Jul. 1964) 4 p Cl. 117-212
(NASA-Case-XMF-01599; US-Patent-3,359,132; US-Patent-Appl-SN-381940) Avail: US Patent Office CSCL 09E

A method of coating copper circuit paths on printed circuit boards to prevent oxidation is described. A printed circuit board is held above a bath of molten solder and flux is applied. The board is then submerged in the bath for a short period of time, withdrawn and spun rapidly to remove excess solder. A smooth, uniform coating is obtained, and an intermetallic compound is formed at the interface, ensuring maximum adhesion of the coating. Official Gazette of the U.S. Patent Office

N71-20788# Naval Research Lab., Washington, D.C.
CONVERSION OF A MANUALLY OPERATED ANTENNA TO A DIGITAL AUTO-TRACKING ANTENNA SYSTEM
George E. Price 7 Dec. 1970 13 p refs
(AD-718961; NRL-7193) Avail: NTIS CSCL 9/5

A systematic approach has been made to the design of a digital auto-tracking antenna system. When such a system is converted from a manual tracking system, the main design criteria of accuracy, reliability, ease of maintenance, and minimum cost are advanced if the new system is designed around one of the present modes of operation, thus minimizing new equipment and permitting the existing modes still to be used when desirable. In the example of this report azimuth and elevation information for two antennas is stored on Mylar tape in binary form. The tape is read by a controller, which reformats and transmits the digital data at specific time intervals to a digital-to-synchro converter for each antenna. The converter outputs syncro position data through the previously existing manual command unit to the pedestal drive circuitry in a servo control loop, also previously existing. Author (GRA)

N71-20798# Norges Tekniske Hoegskole, Trondheim. Elektronikklaboratoriet.
INVESTIGATION OF THE CONDUCTIVITY OF N-TYPE GERMANIUM IN HIGH ELECTRIC FIELDS [UNDERSOEKELSE AV MOBILITETSMETNING VED HOEYE FELTER I N-TYPE GERMANIUM]
T. Thorvaldsen Jan. 1969 81 p refs In NORWEGIAN; ENGLISH summary Sponsored by Roy. Norweg. Council for Sci. and Ind. Res.
(ELAB-AE-118) Avail: NTIS

The present report is an experimental and theoretical investigation of the conductivity of n-type germanium in high electric fields. In the first part the I-V characteristic along the three crystallographic directions (100), (110) and (111) is measured at 293 K and at 77 K. Anisotropy is found at 77 K as well as at 293 K. The theoretical part consists of a qualitative discussion of the anisotropy and of the scattering mechanisms which could be responsible for the velocity-saturation in germanium. Author (ESRO)

N71-20800# Danish Research Centre for Applied Electronics, Copenhagen.

HEAT TRANSFER IN ELECTRONICS: SIMPLE CALCULATION METHODS OF HEAT TRANSFER IN VARIOUS TYPES OF ELECTRONIC EQUIPMENT [VARMETRANSMISSION I ELEKTRONIK: SIMPLE BEREGNINGSMETODER FOR FORSKELLIGE FORMER FOR VARMETRANSMISSION I ELEKTRONIKUDSTYR]

A. Laursen Sep. 1970 37 p In DANISH; ENGLISH summary Sponsored by Sammenslutningen for Palidelighed og Miljoeteknik (ECR-15) Avail: NTIS

When designing electronic equipment it often happens that the thermal properties of the construction are not taken into consideration at an early stage of the development or are insufficiently investigated. The designer may concentrate his work so much on circuit functions that he neglects the advantages which may be obtained in the form of a higher allowable ambient temperature or a longer life for the product had it been developed with an optimal thermal design in view. Admittedly a complete theoretical treatment of the thermal properties of a construction, even a simple one, can be a complicated matter which seldom pays unless in case of very large production series. Nevertheless, it is important to realize at an early stage of the development the possibilities of cooling, the shape and size of the cabinet, etc. Author (ESRO)

N71-20801# Toulouse Univ. (France). Lab. de Genie Electrique.

EXPERIMENTAL AND THEORETICAL STUDY OF LIFETIME CURVES OF SOLID INSULATORS SUBMITTED TO PARTIAL DISCHARGES [ETUDE EXPERIMENTALE ET THEORIQUE DES COURBES DE DUREE DE VIE DES ISOLANTS SOLIDES SOUMIS A L'ACTION DE DECHARGES PARTIELLES]

Ai Bui, A. Guyetand, R. Lacoste, and Van Vui Pham [1970] 22 p refs In FRENCH Avail: NTIS

The influence of partial discharges on the life of insulating materials is reviewed. A theoretical interpretation of experimental results is given assuming a correlation between the energy involved in discharges and the eroded volume in the insulating material. Effects of variation in the dielectric rigidity are evaluated. Conclusions of this study are concerned with accelerated tests using frequencies higher than 50 Hz, the domain of validity of life duration curves, and the definition of a coefficient which characterizes the life of a solid insulator submitted to partial discharges. ESRO

N71-20802# Army Electronics Command, Fort Monmouth, N.J.

INVESTIGATIONS AS TO THE NOISE CHARACTERISTICS OF GaAs AVALANCHE TRANSIT TIME DIODE OSCILLATORS

Joseph J. Baranowski and Vincent J. Higgins Nov. 1970 18 p refs (AD-716990; ECOM-3353) Avail: NTIS CSCL 9/1

Gallium arsenide p-n junction avalanche transit time oscillators were characterized with respect to noise performance. The results of these measurements were compared to other p-n junction oscillators, Read diodes, and Gunn diodes. Measurements include: receiver noise, using these devices as local oscillators for both balanced and single-ended mixer configurations; AM noise sideband-to-carrier ratios; FM noise sideband-to-carrier ratios, and AM and FM noise sideband-to-carrier ratios with cavity locking; thermal noise as a function of reverse bias current and amplifier noise figure. In general, the GaAs devices were superior in all respects to the Si- p-n and Si-Read structures. It also exhibited better FM noise than the Gunn oscillator and only slightly worse AM noise. Author (GRA)

N71-20804# Rensselaer Polytechnic Inst., Troy, N.Y. Systems Engineering Div.

DIGITAL ADAPTIVE SPECTRAL FILTERING

Rob Roy 1970 5 p (Contract DAAB07-69-C-0365) (AD-716974) Avail: NTIS CSCL 9/5

An adaptive procedure for removing a multimodal power spectrum using cascaded transversal digital filters is described. Each section of the overall filter consists of a second order transversal filter whose zero pair is adaptively adjusted to remove one of the modes of the undesired spectrum. The paper is divided into two sections. The paper first treats the case of an unknown but unimodal power spectrum. The second section treats the case where the power spectrum is multimodal, specifically the dual mode case. For this case a gradient approach was used to adaptively adjust the zero pairs of the digital filter to remove the unwanted spectrum. A set of simulation results are presented for various combinations of modal separation and relative power between modes. Author (GRA)

N71-20818* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ELECTRIC ARC APPARATUS Patent

Howard A. Stine, Charles E. Shepard, and Velvin R. Watson, inventors (to NASA) Issued 2 Jan. 1968 (Filed 22 Nov. 1966) 5 p Cl. 73-147 Continuation-in-part of US Patent Appl. SN-366669, filed 11 May 1964 (NASA-Case-XAC-01677; US-Patent-3,360,988; US-Patent-Appl-SN-596338) Avail: US Patent Office CSCL 09E

A stable, high-enthalpy constricted-arc heater with a supersonic nozzle and fixed arc length is described for use in high temperature wind tunnels. The anode, a circumferentially segmented-ring electrode, is located downstream from the nozzle and is electrically insulated from it. A diffuse, regulated current flow with axial symmetry is produced and is unaffected by gas flow. Official Gazette of the U.S. Patent Office

N71-20842* Varian Associates, Palo Alto, Calif.

HIGH POWER-HIGH VOLTAGE WATERLOAD Patent

Duane P. Littlejohn and Arthur E. Reed, inventors (to NASA) Issued 31 Oct. 1967 (Filed 27 Jul. 1966) 4 p 338-82 Sponsored by NASA Prepared for JPL (NASA-Case-XNP-05381; US-Patent-3,350,671; US-Patent-Appl-SN-568352) Avail: US Patent Office CSCL 09E

The principal function of the apparatus is to provide a dummy load in which the current capacity, and the power dissipating capacity, of the load can be readily and conveniently varied during operation of the apparatus. Variability of the load permits operation of the power supply in a stable condition at the rated current, voltage, and power levels at which the power supply operates when it is connected into the operative circuit with which it is used. Official Gazette of the U.S. Patent Office

N71-20846# Toulouse Univ. (France).

AVALANCHE MULTIPLICATION EFFECTS IN SILICON JUNCTIONS [EFFETS DE MULTIPLICATION PAR AVALANCHE DANS LES JONCTIONS AU SILICIUM]

Jean Urgell (Ph.D. Thesis) 1969 170 p refs In FRENCH Avail: NTIS

The p-n and n-p silicon junctions are analyzed. The breakdown voltages for two complementary p-n and n-p junctions are compared leading to the knowledge of the distribution of mobile changes in the space charge. Laws for determining the breakdown voltage in p-i-n and Read junctions are derived. The analyses performed on ideal functions are completed by the definition of different types of imperfection that are common in real functions. Results are applied to voltage regulators and photomultiplier tubes based on avalanche effect. ESRO

N71-20851* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

COAXIAL CABLE CONNECTOR Patent

Albert G. Brejcha, Jr., inventor (to NASA) Issued 12 Dec. 1967 (Filed 14 Jun. 1966) 8 p Cl. 339-177 Sponsored by NASA (NASA-Case-XNP-04732; US-Patent-3,358,264; US-Patent-Appl-SN-557584) Avail: US Patent Office CSCL 09A

The design and development of electric connectors for rigid and semirigid coaxial cables is discussed. The connection is accomplished by providing a pair of flanged shells, each threaded on the outer conductor at the end of one of the cables to be connected. The shells are integrally connected to the outer conductor by a sealant which fills the threads. The shells have milled sides or faces in a direction perpendicular to their longitudinal axes, so that the opposite faces can be brought into mating contact, thus providing electrical and mechanical continuity for the outer conductors. Official Gazette of the U.S. Patent Office

N71-20864* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

POLARIZATION DIVERSITY MONOPULSE TRACKING RECEIVER Patent

Ralph E. Taylor, inventor (to NASA) Issued 19 Dec. 1967 (Filed 30 Aug. 1966) 13 p Cl. 343-16 (NASA-Case-XGS-03501; US-Patent-3,359,555; US-Patent-Appl-SN-576521) Avail: US Patent Office CSCL 09E

A monopulse tracking receiver is described which derives sum and difference signals for vertical and horizontal polarization. The two sum signals are applied to different phase locked loops, each loop including a phase detector and a mixer. The sum signals are also coupled to a third phase locked loop wherein a voltage controlled oscillator feeds the mixers of the first and second phase lock loops so that the signals are modified to be of the same phase. The phase adjusted signals from the mixers in the first pair of phase locked loops are utilized in the respective difference signal networks to control the phase of the difference signals so that they are aligned. The phase aligned difference signals are then combined in a polarization diversity combiner to derive a signal having a component proportional to the position of the target being tracked. Official Gazette of the U.S. Patent Office.

N71-20975*# McDonnell Douglas Astronautics Co., Huntington Beach, Calif.

ELECTRICAL POWER DISTRIBUTION AND USAGE

J. K. Jackson and N. A. Jones *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-day Manned Test of a Regenerative Life Support System 1971 p 301-312 (See N71-20951 20-05)

Avail: NTIS HC$6.00/MF$0.95 CSCL 09E

The electrical power subsystem for the 90-day test included 60 Hz, 115 Vac, 1 phase; 400 Hz, 120/208 Vac, 3 phases; and 28 Vdc. Power usage was recorded by watt-hour meters on each 60-Hz circuit, watt meters on each 400-Hz circuit, and ammeters and voltmeters on the dc circuits. Automatic recording of power data was provided by six power sensors on groups of the ac circuits and a shunt in the dc circuits. These signals were recorded on the low-speed data system. Electrical energy usage was 8,169 kWh on the 60-Hz circuits, 5,885 kWh on the 400-Hz circuits, and 2,257 kWh on the dc circuits. The total energy was 16,012 kWh for an average power consumption of 7,425 watts. Power and energy requirements of each unit are presented. Author

N71-21024# Lincoln Lab., Mass. Inst. of Tech., Lexington.

TWO-DIMENSIONAL WINDOWS

Thomas S. Huang 31 Dec. 1970 13 p refs (Contract F19628-70-C-0230) (AD-717159; TN-1970-41; ESD-TR-70-426) Avail: NTIS CSCL 9/5

Two-dimensional windows find applications in many diverse fields, such as the spectral estimation of random fields, the design of two-dimensional digital filters, optical apodization, and antenna array design. Many good one-dimensional windows have been devised, but relatively few two-dimensional windows have been investigated. In this paper we show that good two-dimensional windows can be obtained by rotating good one-dimensional windows. GRA

N71-21032# Norges Tekniske Hoegskole, Trondheim. Elektronikklaboratoriet.

THEORY OF CROSSED-FIELD TRAVELING WAVE AMPLIFICATION IN SEMICONDUCTORS [TEORI FOR KRYSS-FELT VANDREBOELGE FORSTERKNING I HALVLEDERE]

Steiner Larsen Jan. 1969 85 p refs In NORWEGIAN; ENGLISH summary Sponsored by Roy. Norweg. Council for Sci. and Ind. Res. (ELAB-AE-117) Avail: NTIS

The theory of crossed-field traveling wave amplification in semiconductors is elaborated. The conditions for active amplification have been worked out for the modulated carrier wave alone as well as coupled to an outer slow-wave structure. Author (ESRO)

N71-21033# Siemens A.G., Munich (West Germany).

DEVELOPMENT OF MONOLITHIC INTEGRATED MOS-CIRCUITS [ENTWICKLUNG VON MOS-BAUELEMENTEN, INSBESONDERE DEREN MONOLITHISCHE INTEGRATION]

Guenter Eberhard and Manfred Zerbst Bad Godesberg Bundesmin. fuer Bildung und Wiss. Nov. 1970 65 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss. (BMBW-FB-W-70-62) Avail: NTIS; ZLDI Munich: 13.28 DM

The development of planar technology has been pursued for constructing integrated MOS-circuits. This has led to the development of techniques for homogenous oxidation of large surfaces and of a methodology for boron and phosphorus diffusion, suitable for large-scale integration. The technology has been applied for manufacturing n-channel MOS selection matrices and a p-channel MOS shift register. For this purpose the circuit design and the topography needed for implementation have been established. There have been preparations for large-scale integration of new circuits. Author (ESRO)

N71-21056# Norges Tekniske Hoegskole, Trondheim. Elektronikklaboratoriet.

ELECTRON MOBILITY IN CADMIUM SULFIDE [ELEKTRONMOBILITET I KADMIUMSULFID]

H. Hanebrekke Jan. 1969 51 p refs In NORWEGIAN; ENGLISH summary Sponsored by Roy. Norweg. Council for Sci. and Ind. Res. (ELAB-TE-120) Avail: NTIS

The load carrier transport in cadmium sulfide is discussed. By studying the predominant types of dispersion in load carriers one has been able to estimate the Hall- and drift mobilities. Numerical evaluations are shown in diagrams. Special emphasis has been made on the electron mobility of thin cadmium sulfide films. Measurements of the Hall mobility as a temperature function have been made for single crystal cadmium sulfide and cadmium sulfide films. An exponential connection between mobility and temperature was observed in the films, in accordance with other available data for such films. Author (ESRO)

N71-21081# North Carolina State Univ., Raleigh.

A DIFFERENT APPROACH TO QUANTIZING NOISE ANALYSIS IN DELTA MODULATORS Interim Report

Thomas Kreske Mills 22 Jun. 1970 65 p refs (Contract F44620-69-C-0033; Proj. Themis) (AD-717221; AFOSR-70-2937TR) Avail: NTIS CSCL 9/5

A new approach for determining quantizing noise in delta modulators has been developed. This approach has been applied

to the delta modulation of first order Markov sources. The analysis technique avoids the necessity of dichotomizing quantizing noise into slope overload and granular components, and working with them independently. Formulae, which can be evaluated numerically, are developed for quantizing noise probability density functions and power spectra. Computer solutions are presented and compared with previous simulation results. Generalization of the method to Differential Pulse Code Modulation systems is discussed. Author (GRA)

N71-21087*# Systems Technology, Inc., Hawthorne, Calif.
PRINCIPLES FOR THE DESIGN OF ADVANCED FLIGHT DIRECTOR SYSTEMS BASED ON THE THEORY OF MANUAL CONTROL DISPLAYS
D. H. Weir, R. H. Klein, and D. T. McRuer Washington NASA Mar. 1971 97 p refs
(Contract NAS2-3746)
(NASA-CR-1748) Avail: NTIS CSCL 01D

Recent developments in the theory of manual control displays lead to principles for analytical design of flight directors, given the dynamics of the (augmented) vehicle and its manual control system. The theory shows that there are effective director/vehicle controlled element dynamics which are preferred from the standpoint of pilot response and system performance. Other considerations include response compatibility, display consistency, director/vehicle system which satisfies both pilot-centered and guidance control requirements. The analytical process for longitudinal control of transport-type aircraft during landing approach is discussed. Author

N71-21211# Aerospace Corp., El Segundo, Calif. Lab. Operations.
A FOCUSED APERTURE MILLIMETER WAVE TRANSMISSION LINE, JUNE 1969–JUNE 1970
Cleyon O. Yowell 1 Nov. 1970 21 p refs
(Contract F04701-70-C-0059)
(AD-716808; TR-0059; SAMSO-TR-70-436) Avail: NTIS CSCL 9/1

Design details are presented for an open waveguide radar transmission line. This 94 GHz quasi-optical guide is presently in use with two focusing mirrors and offset feeds providing power transfer and rotary joint action for a scanning 15 diameter parabolic antenna. Experimental results are given for the beam shapes, phase contours, insertion loss, and isolation of the beam guide. Author (GRA)

N71-21212# Raytheon Co., Bedford, Mass. Missile Systems Div.
ANALYSIS AND ELEMENT PATTERN DESIGN OF PERIODIC ARRAYS OF CIRCULAR APERTURES ON CONDUCTING CYLINDERS
Giorgio V. Borgiotti and Quirino Balzano Nov. 1970 132 p refs
(Contract F19628-70-C-0226)
(AD-717199; SCIENTIFIC-1; BR-6129; AFCRL-70-0682) Avail: NTIS CSCL 9/5

The analysis and the design of the elements of a large array of circular apertures on a triangular grid is approached by modeling the antenna as an infinite structure rotationally symmetric and periodic along the cylinder axis. Because of this particular symmetry every possible excitation is the superposition, with suitable weights, of a set of fundamental excitations having uniform magnitude and linear phase progression in the azimuthal direction and in the direction of the cylinder axis (eigenexcitations). Thus, by invoking superposition the electromagnetic analysis of the array is reduced to the solutions of the simpler boundary value problems pertinent to the set of eigenexcitations. This is done by expanding the field in normal modes in the region exterior to the cylinder and in the waveguides feeding the apertures, followed by a field matching at the cylinder surface (obtained approximately through Galerkins method). The realized gain pattern of the radiators can be modified to a considerable extent by using an element pattern shaping network (in the radiator waveguides), serving the purpose of matching the array for a selected eigenexcitation. Criteria for the network design are given. A series of numerical examples illustrates the technique and shows that a flat element pattern can be thus obtained with a gain fall off with respect to the peak of less than 6 db at 80 degrees. Author (GRA)

N71-21224# Sandia Corp., Livermore, Calif.
MODEL 50-600-75 MANGANIN PULSE POWER SUPPLY
E. O. Williams Dec. 1970 32 p refs Sponsored by AEC
(SCL-DR-70-130) Avail: NTIS

The Model 50-600-75 Manganin pulse power supply both transmits power to piezoresistive gages and receives the signal which results from these gages. The supply is designed for a 50-ohm gage system, provides a maximum source voltage of 600 volts, has a frequency response of greater than 100 MHz, and incorporates an adjustable cable compensator. Author

N71-21236 National Lending Library for Science and Technology, Boston Spa (England).
SWITCH-ON TIMES AND CHARGE-TRANSFER MECHANISMS IN MOS TRANSISTORS
K. Goser 18 Sep. 1970 21 p refs Transl. into ENGLISH from Arch. Elec. Uebertrag. (West Germany), v. 24, no. 1, 1970 p 21–28
(NLL-Trans-2657-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.

The switching behavior of concentrated MOS transistors, in particular the dependence of the switch-on time upon the transistor dimensions, is discussed for the region outside saturation in terms of a simple model whose validity is tested through the medium of experimental results. In discussing the switching characteristics, some discussion of the charge transfer mechanism which takes place during switching, between substrate and channel, and which stems from the displacement of free charge carriers in the substrate during the development of the channel, is made. In closing, the switch-on times of MOS transistors are computed on the basis of the model, are compared with those of bipolar transistors. Author

N71-21246# Rensselaer Polytechnic Inst., Troy, N.Y. Systems Engineering Div.
DIGITAL FILTER REALIZATIONS OF ARBITRARY LOSS AND DELAY FUNCTIONS
Willem Steenaart, Gerard C. Maenhout, and R. Jay Murphy 1970 6 p refs
(Contract DAAB07-69-C-0365)
(AD-717101) Avail: NTIS CSCL 9/5

As digital filters are often specified in the frequency domain, a method of approximation is required that meets periodic magnitude and delay or phase specifications. The method developed here is of particular merit as it may be used for any type of frequency characteristic, e.g., as required for the equalization of communication channels. Existing non-recursive filter realization methods realize linear phase filters only, whereas this method can correct magnitude and subsequently the delay of a system function, realizing non-recursive, purely recursive or recursive filters. Author (GRA)

N71-21247# Sandia Corp., Albuquerque, N.Mex. TM Development Div.
AN INTRODUCTION TO AM FREQUENCY DIVISION MULTIPLEX TELEMETRY SYSTEMS
C. S. Johnson Dec. 1970 102 p refs Sponsored by AEC
(SC-M-70-684) Avail: NTIS

An introduction is given to AM subcarrier telemetry systems, both historically and technically. The types of subcarriers and the

systems that can be implemented with them are described. The problems associated with both designing and using AM subcarrier telemetry systems are covered. Author

N71-21302# Addis Translations International, Woodside, Calif.
EFFECT OF COMPONENT TOLERANCES ON THE TRANSFER CHARACTERISTICS IN THE FREQUENCY RANGE
Otto Mildenberger 1970 26 p refs Transl. into ENGLISH from NTZ-Nachr. Z. (Brunswick) v. 23, 1970 p 85–92 Sponsored by AEC Prepared for Sandia Corp.
(SC-T-70-4048) Avail: NTIS

An arbitrary current for an arbitrary voltage is considered when a linear passive network is excited with a current or voltage. It is assumed that some or all of the network's components deviate from their precalculated nominal values. A method for calculating the transfer function, attentuation coefficients, and phase and reflection factors is outlined. A method of solution in the time range, mean values and scatters in the frequency range, approximative calculation of the mean values and scatters from the corresponding values for X(omega) and Y(omega) in two terminal networks, and composite circuits are includes. Y.M.

N71-21329*# General Electric Co., Schenectady, N.Y.
CADMIUM ELECTRODE MECHANISM ELECTRODE MORPHOLOGY AND CAPACITY Final Report
F. G. Will and H. J. Hess 15 Mar. 1971 89 p refs
(Contract NAS3-12968)
(NASA-CR-72777) Avail: NTIS CSCL 09E

Changes in the capacity and morphology of cadmium film electrodes during cycling in 0.1 to 6N potassium hydroxide solutions were studied, using in-situ microscopy and scanning electron microscopy. In stirred bulk solutions under conditions of uniform current distribution, a dissolution mechanism dominates in concentrated hydroxide and accounts for the large initial capacities and for the pronounced changes in morphology and loss of capacity on cycling. Indilute hydroxide, a solid state mechanism prevails and explains the small capacities and the lack of changes in morphology and capacity. In the case of thin electrolyte films, simulating the nonuniform current distribution in a single pore of battery plate, dissolution and precipitation of cadmium species causes substantial loss of capacity during cycling, while the remaining capacity is due to small particles reacting via a solid state mechanism. Author

N71-21351*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ELECTRONIC PARTS ENGINEERING
In its Space Programs Sum. No. 37-66, Vol. 3, Oct.–Nov. 1970 31 Dec. 1970 p 145–147 (See N71-21338 10-30)
Copyright. Avail: NTIS CSCL 09E

A literature and data evaluation effort is reported that established radiation criteria for electronic parts of the thermoelectric outer planet spacecraft. Determined were permanent degradations of parameters, temporary drifts of parameters, parameter degradation factors, and radiation hardening and screening procedures. Results show that capacitors, relays and switches, resistors, and magnetic devices are not affected by estimated radiation levels for the thermoelectric powered spacecraft; but other active electronic components will be seriously degraded by radiation during interplanetary missions. G.G.

N71-21386# Sandia Corp., Albuquerque, N.Mex.
PULSED SOLID-STATE SOURCES FOR MICROWAVE APPLICATION
W. E. Wilson Oct. 1970 52 p refs Sponsored by AEC
(SC-DR-70-698) Avail: NTIS

The current status of two high peak power microwave oscillators, LSA and TRAPATT, is reviewed in terms of their implementation potential. Following a listing of their present capabilities in terms of peak power, average power, and frequency, a general discussion is given on their characteristics when viewed from an applications sense also how they behave as bias, temperature, or load VSWR is varied, what their radiation sensitivity is, and what type of pulser they require. Small volume, developmental solid state sources consisting of both oscillator and modulator are described. The sources are seen to be complementary rather than being in direct competition, due to their preferred operating frequency ranges. TRAPATT, while being less sensitive to changes in bias or temperature, as well as being capable of higher average power and efficiency, has a peak power frequency squared product considerably lower than LSA. Finally, it is shown that the types of systems for which these sources are most ideally suited are those whose peak power requirements are commensurate with the peak power available from a single source. Author

N71-21387# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LIGHT DIODE MATRICES MADE FROM SILICON CARBIDE FOR INDICATORS OF ETsVM
V. A. Balashov et al 3 Sep. 1970 13 p refs Transl. into ENGLISH from Mikroelektron. (USSR), no. 2, 1968 p 201–207
(AD-716941; FTD-MT-24-81-70) Avail: NTIS CSCL 13/1

Utilization of integrated circuits as ETsVM elements makes possible a considerable increase in their reliability; in this case the size, weight and power of these devices is decreased. Accordingly new requirements are being placed on light indicators of ETsVM. Indicators and elements of control circuits must meet rigid climatic and mechanical requirements, operate on low power and match with control voltages and currents with integrated circuits. In the present article problems of creation of reliable indicators satisfying the above requirements, using semiconductor light indicator elements are considered. These indicator elements are semiconductor diodes made from material with a broad forbidden band. When forward bias is applied to such a diode, nonequilibrium carriers passing through the junction recombine; moreover, part of them recombine with radiation of quanta of visible or infrared radiation. The magnitude of quanta energy depends on the width of the forbidden band of the material and the nature of the center responsible for emission recombination. Visible radiation of diodes from GaP is already being used in small sources of light. However, utilization of light indicator devices in the form of a shining point is not always expedient, since the results of calculations conducted on ETsVM are conveniently transferred. GRA

N71-21448* Westinghouse Electric Corp., Pittsburgh, Pa.
REGULATED POWER SUPPLY Patent
John F. Ringelman and Henry B. Airth, Jr., inventors (to NASA) Issued 26 Sep. 1967 (Filed 10 Nov. 1964) 4 p Cl. 323-22 Sponsored by NASA
(NASA-Case-XMS-01991; US-Patent-3,344,340; US-Patent-Appl-SN-410326) Avail: US Patent Office CSCL 09E

A power supply having a starting circuit which allows sufficient voltage to be applied to the output side of the power supply when it is first turned on and does not affect the voltage regulator performance during normal operation is described. Basically, the starting circuit remains active until the regulated output voltage reaches a given voltage level, whereupon the starting circuit is deactivated and the regulator circuitry controls the output voltage at the desired value. Official Gazette of the U.S. Patent Office

N71-21583* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH VOLTAGE DIVIDER SYSTEM Patent
Glen E. Mealy, inventor (to NASA) Issued 4 Jul. 1967 (Filed 14 Sep. 1965) 5 p Cl. 338-64
(NASA-Case-XLE-02008; US-Patent-3,329,918; US-Patent-Appl-SN-487342) Avail: US Patent Office CSCL 09E

A high voltage divider system having gradient divider resistors enclosed in a corona inhibiting environment is described. The electrical apparatus is housed in a vapor tight container with a desicant and a fan for circulating the enclosed air.
Official Gazette of the U.S. Patent Office

N71-21611*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
FREQUENCY ASYMPTOTES AND ASYMPTOTIC ERROR FOR DISTRIBUTED-PARAMETER SYSTEMS
William W. Happ Washington Mar. 1971 39 p refs
(NASA-TN-D-5874; C-127) Avail: NTIS CSCL 09C

The frequency response techniques for lumped parameter systems are reviewed and extended to distributed-parameter circuit elements. For example, a three-terminal RC network can be specified by a set of asymptotes for amplitude and phase with an error usually less than 2 db or 20 degrees, respectively. For any two-port a preferred set of six asymptotes can be defined from which asymptotes for all network function can be derived. This set of functions, referred to as deviations, corresponds to network polynomials in lumped parameter circuits. Properties of deviations are summarized and adapted for computation of frequency asymptotes and asymptotic error estimates of distributed-parameter systems. Examples include uniform and tapered thin film networks.
Author

N71-21612*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE IMP-F AND G PREBOOST REGULATOR
G. Ernest Rodriguez Mar. 1971 27 p
(NASA-TM-X-65483; X-761-71-104) Avail: NTIS CSCL 09E

The preboost regulator was used as a main bus regulator in the IMP-F and G spacecraft. Two voltage-regulated, current-limited busses, used on the spacecraft for instruments and experiments, define the output of the regulator, while the parallel combination of the solar array, battery, and shunt regulator determines the input characteristics. A series switching regulator operating at 5 kHz and controlled by a simple magnetic amplifier provides a voltage output of 11.7 volts for a majority of the instruments and experiments, while a dc to dc converter operating from the 11.7 v line adds 16.3 volts to it and thereby provides a 28 v bus for the transmitter and other experiments. A current transformer is utilized for load current sensing and is effectively coupled to the magnetic amplifier for current limiting-short circuit protection on both outputs.
Author

N71-21677# Bureau of Reclamation, Denver, Colo. Electric Power Branch.
OUT-OF-STEP SWITCHING FIELD EVALUATION TESTS OF A 230-kV OIL CIRCUIT BREAKER. COLORADO RIVER STORAGE PROJECT
G. W. Cleaveland Nov. 1970 24 p refs
(PB-196871; REC-OCE-70-53) Avail: NTIS CSCL 09A

Out-of-step switching problems for oil circuit breakers on the Bureau of Reclamation system are reviewed and steps taken to remedy the problems are described. Out-of-step switching field tests conducted on a modified 230-kv, 15,000-mva breaker to evaluate the modification for this type of service are presented. The modified breaker performed satisfactorily to 2.5-per-unit recovery voltage during actual out-of-step switching conditions at about 20% of its interrupting rating (since resistor current interruption is more difficult at this low percentage of interrupting rating). Tables, oscillograms, and illustrations related to the evaluation of the modification for out-of-step switching service are included.
Author (GRA)

N71-21734# Bureau of Radiological Health, Rockville, Md. Div. of Electronic Products.
INEXPENSIVE READOUT FOR A COMMERCIAL THERMOCOUPLE MICROWAVE POWER DENSITY PROBE
Robert L. Cloke Dec. 1970 21 p refs
(BRH/DEP-70-31) Avail: NTIS

An inexpensive, easy-to-build readout circuit which can be used with the Narda 8122 thermocouple microwave power density probe is described. The instrument is capable of reading full-scale power densities of 10 milliwatts per per square centimeter and 100 milliwatts per square centimeter frequencies of 915 MHz and 2450 MHz, and includes all of the necessary features of the Narda 8100 system.
Author (GRA)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N71-20680# IIT Research Inst., Chicago, Ill.
SELF-ORGANIZING NETWORKS Final Summary Report, 1961–1970
Scott H. Cameron Feb. 1970 13 p
(Contract Nonr-3392(00))
(AD-716798; IITRI-E6125) Avail: NTIS CSCL 9/2

Photochromic perceptron; The complexity of threshold networks; Adaptive strategies for logically deep networks; Formal synthesis of threshold networks; Species adaptation; Maximum scope approximations; Hand printed character recognition; The DIALOG system; Programming by sequential selection among high-level alternatives; Theory of wirability.
GRA

N71-20681# Joint Publications Research Service, Washington, D.C.
RECOGNITION DEVICES
Yu. P. Safronov et al 8 Mar. 1971 76 p refs Transl. into ENGLISH of the book 'Raspoznayushchiye Ustroystva' Moscow, Voyenizdat Press, 1970 p 1–88
(JPRS-52554) Avail: NTIS

The development of reading automata, medical diagnostic machines, devices predicting meteorological processes and promising military systems are discussed. Models and materials on the principles of the design and use of recognition devices are cited. Problems involved in the use of recognition devices in various areas of civilian technology and medicine are analyzed.
Author

N71-20782* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AMPLIFIER CLAMPING CIRCUIT FOR HORIZON SCANNER Patent
Clarence Cantor, inventor (to NASA) Issued 17 Oct. 1967 (Filed 14 Sep. 1964) 5 p Cl. 250-206
(NASA-Case-XGS-01784; US-Patent-3,348,053; US-Patent-Appl-SN-396444) Avail: US Patent Office CSCL 09E

An amplifier clamping circuit having a unique combination of input and output filters together with an output clamping scheme is described. The circuit is to be used with a pulse source in which the pulses having a dc bias level subject to variations that are large compared to the amplitude of the pulse are to be measured, and where the pulse amplitude and shape are irregular and variable. The input and output filters may be both of the same general form but the input filter time constant is substantially greater than that of the output filter, and the output filter is periodically clamped to ground for a short time and then unclamped before the next pulse is received.
Official Gazette of the U.S. Patent Office

N71-20841* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DIVERSITY RECEIVING SYSTEM WITH DIVERSITY PHASE LOCK Patent
Vincent J. DiLosa and Charles R. Laughlin, Jr., inventors (to NASA) Issued 17 Oct. 1967 (Filed 23 Mar. 1964) 7 p Cl. 325-305
(NASA-Case-XGS-01222; US-Patent-3,348,152; US-Patent-Appl-SN-354182) Avail: US Patent Office CSCL 09E

A diversity receiving system having a primary phase lock loop for utilizing the optimum pre-detected combined signal to insure phase lock of the system is described. Two secondary phase lock coherent automatic gain control loops adjust the non combined signals so that they are equal in amplitude and phase coherent. The primary phase lock loop essentially includes a phase detector for comparing the phase of the optimum combined signal with the phase of a signal from a reference oscillator and a voltage controlled oscillator for utilizing the output from the phase detector so that the two diversity channels are maintained in phase lock.
Official Gazette of the U.S. Patent Office

N71-20852* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SIGNAL DETECTION AND TRACKING APPARATUS Patent
David H. Schaeffer, inventor (to NASA) Issued 2 Jan. 1968 (Filed 30 Sep. 1966) 12 p Cl. 331-17
(NASA-Case-XGS-03502; US-Patent-3,361,985; US-Patent-Appl-SN-584066) Avail: US Patent Office CSCL 09C

The design and development of a digital approach to detecting an out of frequency condition between an internal signal and an external signal is discussed. The generation of digital signals is used to bring the internal signal into synchronism with the external signal. The circuit also provides a means for sensing low level signals in order to determine the presence or absence of a signal.
Official Gazette of the U.S. Patent Office

N71-20893# California Univ., Berkeley.
A REVIEW OF RECENT DEVELOPMENTS IN INTEGRATED CIRCUITS
H. De Man (Louvain Univ.) May 1970 31 p refs Sponsored partly by ESRO and NSF
Avail: NTIS

A review is given of recent developments in the integrated circuits area and possible future evolutions are indicated. Digital and linear circuits as well as optoelectronic devices and computer aided design are considered and an extensive bibliography on each subject is presented.
Author (ESRO)

N71-21285 California Inst. of Tech., Pasadena.
DOUBLE INJECTION: HIGH FREQUENCY NOISE AND TEMPERATURE DEPENDENCE
Don Howard Lee (Ph.D. Thesis) 1969 141 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 70-4296

Noise measurements from 140 K to 350 K ambient temperature and between 10 kHz and 22 MHz performed on a double injection silicon diode as a function of operating point indicate that the high frequency noise depends linearly on the ambient temperature T and on the differential conductance g measured at the same frequency. The noise is represented quantitatively. A new interpretation demands Nyquist noise with alpha 1 in these devices at high frequencies. This is in accord with an equivalent circuit derived for the double injection process. The effects of diode geometry on the static I-V characteristic as well as on the ac properties are illustrated. Investigation of the temperature dependence of double injection yields measurements of the temperature variation of the common high-level lifetime, the hole conductivity mobility, and the electron conductivity mobility.
Dissert. Abstr.

N71-21300# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH POWER ELECTRONICS: Selected Articles
F. S. Rusin et al 26 Oct. 1970 133 p refs Transl. into ENGLISH from Elektron. Bolshikh Moshchnostei (USSR) no. 2, 1963 p 1-108, 157-166
(AD-717029; FTD-HC-23-260-70) Avail: NTIS CSCL 9/1

Contents: Cathode losses in magnetrons; An electrodynamic theory of grids; Toward an electrodynamic theory of grids; Normal coordinates in the theory of closed resonance chains; A theory of non-contact plungers; Diaphragms for wave H sub 01 in a circular wave guide; and Dosimeters of electromagnetic vibrations in the decimeter range.
GRA

N71-21473* ITT Corp., Nutley, N.J.
TRACKING RECEIVER Patent
Walter L. Glomb, Wenelin Janeff, and Edmondo Imboldi, inventors (to NASA) Issued 5 Sep. 1967 (Filed 30 Sep. 1963) 7 p Cl. 343-113 Sponsored by NASA
(NASA-Case-XGS-08679; US-Patent-3,340,532; US-Patent-Appl-SN-312443) Avail: US Patent Office CSCL 09C

The design and development of an improved and simplified tracking receiver of monopulse type is described. The purpose of the invention is to provide a receiver which will track a satellite and receive communications from the satellite under adverse noise conditions. The system contains an antenna providing signals which indicate antenna sighting relative to target position and circuits for correcting the antenna position.
Official Gazette of the U.S. Patent Office

N71-21483* Radiation Systems, Inc., McLean, Va.
MONOPULSE TRACKING SYSTEM Patent
John Paul Shelton, Jr., inventor (to NASA) Issued 26 Sep. 1967 (Filed 13 Jun. 1966) 19 p Cl. 343-16 Sponsored by NASA
(NASA-Case-XGS-01155; US-Patent-3,344,425; US-Patent-Appl-SN-557871) Avail: US Patent Office CSCL 09C

A monopulse tracking system having an antenna array of at least three radiators for deriving circularly polarized sum and difference mode patterns is described. In the case where the spiral array has four radiating elements, these elements are connected through a hybrid network to derive sum and difference signals which are phase compared to develop azimuth and elevation information. The inclusions of a larger number of radiating elements increases the angle at which a target can be detected relative to the antenna boresight axis.
Official Gazette of the U.S. Patent Office

N71-21543*# Martin Marietta Corp., Denver, Colo.
LINEAR MODULATOR TEST PROCEDURE AND REPORT
Mar. 1971 78 p
(Contract NAS8-25987)
(NASA-CR-103082; MCR-71-82) Avail: NTIS CSCL 09C

The test procedures and results are presented for the modulator, demodulator and phase locked loops breadboard. The equipment used during the tests is outlined. Some parts of the demodulator were used while testing the modulator such as filters to provide clean signals and a balanced modulator to act as a phase detector. The phase locked loops were tested without and with the modulator, phase locked loops, and demodulator connected as a system. The modulator and phase locked loops were then used to provide the input signals for testing of the demodulator.
Author

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N71-20649# California Univ., Berkeley. Lawrence Radiation Lab.
STATUS OF THE ERA RESEARCH AT BERKELEY
Denis Keefe Oct. 1970 12 p refs Presented at Proton Linear Accelerator Conf., Batavia, Ill., 28 Sep.–2 Oct. 1970
(Contract W-7405-eng-48)
(UCRL-20125; CONF-700929-3) Avail: NTIS

The Compressor 3 experiment at the Astron facility is reviewed, and the Berkeley 2-MeV electron linear induction accelerator and the Compressor 4 apparatus are described. Also, conceptual studies of an electron-ring accelerator for acceleration of protons to high energies at high intensities are outlined. NSA

N71-20688# Argonne National Lab., Ill.
ENGINEERING DEVELOPMENT OF FLUID BED FLUORIDE VOLATILITY PROCESSES. PART 16: A SAFETY MANUAL FOR THE ENGINEERING-SCALE ALPHA FACILITY
B. J. Kullen, W. A. Murphy, E. L. Carls, N. M. Levitz, G. J. Vogel et al Apr. 1970 91 p refs
(Contract W-31-109-eng-38)
(ANL-7672) Avail: NTIS

Safety procedures and warning and protective devices used in the operation of a plutonium-processing facility are described. Hazards protected against are release of radioactive or other noxious materials, fires, criticality, failure of electric power, process abnormalities, and explosion hazards. Also considered are safe procedures for routine operations, such as processing operations, material transfer into and out of gloveboxes, and waste disposal. Author (NSA)

N71-20792# North Star Research and Development Inst., Minneapolis, Minn.
DEVELOPMENT OF A HEAT AND MASS TRANSFER TEST FACILITY Final Technical Report
R. E. Larson and L. T. Banner Jun. 1970 23 p
(Contract DAAG17-70-C-0048)
(AD-716987; TR-71-12-CE) Avail: NTIS CSCL 14/2

The objective of the program was to design a heat and mass transfer test facility and fabricate a skin-simulator model, which is an important part of the test facility. This facility was designed to allow experimental determinations of the transfer of heat and moisture through composite clothing systems under a variety of simulated ex ernal and internal ventilating flow conditions. Author (GRA)

N71-20859# Entwicklungsring Nord, Bremen (West Germany).
EUROPEAN EXPERIMENTAL RESEARCH ON RE-ENTRY VEHICLE CONFIGURATIONS
H. Tolle 1970 40 p refs Presented at the 4th EUROSPACE US-European Conf., Venice, 22–25 Sep. 1970
Avail: NTIS

The tests performed in French and German wind and shock tunnels for studying the thermal and stability behavior of some configurations of reentry vehicles in different flow regions, are listed. ESRO

N71-21402# Royal Aircraft Establishment, Farnborough (England).
STUDY OF A SHOCK TUBE OF PYRAMIDAL FORM FOR THE GENERATION OF AN N-WAVE: SEQUEL TO NOTE N1/69 [ETUDE D'UN TUBE A CHOC DE FORME PYRAMIDALE POUR LA GENERATION D'UNE ONDE EN N: SUITE A LA NOTICE N1/69]
A. Peter et al Jul. 1970 91 p refs Transl. into ENGLISH from French report T11/70
(RAE-LIB-TRANS-1496) Avail: NTIS

After noting the characteristics of waves and the simulation of N-waves of real duration by means of a shock-tube of pyramidal form, the principle of the apparatus used is described in detail. The formation of the N-wave in a simulator with spherical geometry and distortions expected from a change in geometry are explained using acoustic theories. The experiments carried out on simulator models are described to show the effect of the tube geometrical parameters (shape of the high-pressure chamber, angle of opening of the tube and changes of slope in the shape of the tube) on the wave profile. The results obtained show that to obtain an accurate N-wave there cannot be many departures from the spherical geometry of the apparatus. The problems connected with membrane rupture under the very slight overpressures needed to produce waves of the desired intensity are examined. A quantitative study is made of the apparatus designed to absorb the wave after its passage through the measurement chamber; an effective technique consists of a closure of the expansion chamber by means of a second pyramid with its surface perforated, and whose total cross-section represents about 10% of the end cross-section of the expansion tube. A full-size simulation system is outlined with notes on its production in the region of small shock waves. Author

N71-21474* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SUBGRAVITY SIMULATOR Patent
Harold I. Johnson and Arthur G. Trader, inventor (to NASA) Issued 11 Jul. 1967 (Filed 16 Aug. 1965) 14 p Cl. 35-12
(NASA-Case-XMS-04798; US-Patent-3,330,052; US-Patent-Appl-SN-480210) Avail: US Patent Office CSCL 14B

An apparatus for indoctrinating astronauts to the effects of reduced lunar gravity is described. A cylinder and pneumatic servo acting in conjunction with a spring balance which weighs the piston and cylinder assembly from which the trainee is suspended provides an upward force equal to five-sixths of the trainee's weight. The remaining one-sixth of the trainee's weight duplicates conditions of lunar gravity and provides an environment for training. Author

N71-21475* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HYPERSONIC TEST FACILITY Patent
Frank L. Clark, Charles B. Johnson, Wayne D. Erickson, and Roger I. Buchanan, inventors (to NASA) Issued 18 Jul. 1967 (Filed 29 Jul. 1965) 8 p Cl. 73-343 Continuation-in-part of US Patent Appl. SN-266107, filed 18 Mar. 1963
(NASA-Case-XLA-05378; US-Patent-3,331,246; US-Patent-Appl-SN-484156) Avail: US Patent Office CSCL 14B

A hypersonic test facility for ablation studies and other testing of aeronautic and space vehicles under conditions of high pressure and high temperature is described. The principal feature of the test facility is the incorporation of a heat exchange facility for heating a gas under high pressure from room temperature to more than 3,000 degree R, with the further capability of continuous operation for a period of fifteen minutes or more while maintaining a steady state high exit gas temperature. Official Gazette of the U.S. Patent Office

N71-21480# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
CRYOGENIC FLOW RESEARCH FACILITY PROVISIONAL ACCURACY STATEMENT
J. W. Dean, J. A. Brennan, D. B. Mann, and C. H. Kneebone 1 Feb. 1971 38 p refs
(NBS-9778) Avail: NTIS

A cryogenic flow research facility was constructed and was first used to evaluate commercially available cryogenic flow-meters operating with liquid nitrogen on a positive displacement principle. The performance of the flow facility was simultaneously being evaluated during the meter tests. A summary is given of the performance evaluation of the flow facility and an accuracy statement is given for both totalized mass and volumetric flow. Author

N71-21481* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

MULTILEGGED SUPPORT SYSTEM Patent
Weymouth B. Crumpler, inventor (to NASA) Issued 10 Oct. 1967 (Filed 29 Dec. 1964) 6 p Cl. 73-147
(NASA-Case-XLA-01326; US-Patent-3,345,866; US-Patent-Appl-SN-422097) Avail: US Patent Office CSCL 14B

A multilegged support system holds and positions a test model with respect to a wind tunnel balance and sting mount. A group of legs are located at opposite ends of the test model and are rigidly fixed to it and the balance forming the support. The legs are equally spaced about the group, flexible, and as long and thin as adequate support will allow. They are positioned essentially normal to the direction of model skin growth during thermal expansion. Official Gazette of the U.S. Patent Office

N71-21622# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
X-RAY AND NUCLEAR RADIATION FACILITIES, PERSONNEL SAFETY FEATURES
W. T. Mason, E. W. Pipes, T. R. Rucker, D. N. Smith, and C. W. West 18 Dec. 1970 71 p
(Contract W-7405-eng-26)
(Y-1754) Avail: NTIS

The development and implementation of these standards are described and the general philosophy and approach to these standards are outlined. The use of a matrix (type of installation versus radiation safety feature) to facilitate equipment classification and personnel safety feature requirements is presented. Included is a set of the standards showing formats, matrices, etc., and the detailed standards for each safety feature. Author (NSA)

N71-21699# National Oceanographic Instrumentation Center, Washington, D.C.
NATIONAL OCEANOGRAPHIC INSTRUMENTATION CENTER RESOURCES AND FACILITIES
Feb. 1971 32 p
Avail: Issuing Activity

The history and structural design of the National Oceanographic Instrumentation Center which evaluates oceanographic instruments and collects and disseminates technical information about the equipment are presented. Cooperative programs conducted among governmental agencies, academic laboratories, and industry are briefly mentioned. J.A.M.

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N71-20689# ARO, Inc., Arnold Air Force Station, Tenn.
PREDICTION OF MOLECULAR SCATTERING EFFECTS IN FREE JET EXPANSIONS Final Report, Apr. – May 1970
J. A. Benek Arnold AF Sta., Tenn. AEDC Jan. 1971 48 p refs
(Contract F40600-71-C-0002)
(AD-717158; ARO-VKF-TR-70-264; AEDC-TR-70-273) Avail: NTIS CSCL 7/4

The effects of background pressure on reduction of molecular beam intensity are investigated. A theoretical model is developed which shows the background to be separable into two distinct components: one attributable to reflected jet particles and the other attributable to residual (unpumped) particles. An expression for the Fenn and Anderson correlation parameter is obtained. Comparisons of the data of several investigators are made with theoretically predicted values of intensity as a function of either separation distance or source pressure. The characteristic dip in the intensity versus source pressure curve has been related to scattering effects as well as to condensation effects. Author (GRA)

N71-20709*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE COMPRESSIBLE TURBULENT BOUNDARY LAYER ON A BLUNT SWEPT SLAB WITH AND WITHOUT LEADING-EDGE BLOWING
James L. Hunt, Dennis M. Bushnell, and Ivan E. Beckwith Washington Mar. 1971 62 p refs
(NASA-TN-D-6203; L-7433) Avail: NTIS CSCL 20D

Predictions of surface heating are compared with experimental data on a 60 deg swept, blunt, slab configuration with and without leading edge blowing. The test conditions were a free stream Mach number of 8, a wall-to-total temperature ratio of 0.4, and a range of free stream Reynolds number, based on leading edge diameter, from 920,000 to 930,000. Predictions for surface streamlines, Mach number profiles, and boundary layer thickness were also compared with experimental data, but for zero blowing only. These comparisons indicated that for test Reynolds numbers of 260,000 or larger, the leading edge boundary layer was turbulent. As the flow expanded around the leading edge onto the slab, the turbulent boundary was apparently laminarized. The chordwise location of the apparent laminarization was influenced by the leading edge blowing at the largest test blowing rates. Tentative conclusions regarding the validity of assumed eddy-viscosity models for three dimensional turbulent boundary layers were also obtained. Author

N71-20815* Brown Engineering Co., Inc., Huntsville, Ala.
METHOD OF RECORDING A GAS FLOW PATTERN Patent
Trevor T. Mordecai, inventor (to NASA) Issued 5 Dec. 1967 (Filed 20 Jan. 1966) 4 p Cl. 346-1 Sponsored by NASA
(NASA-Case-XMF-01779; US-Patent-3,357,024; US-Patent-Appl-SN-521999) Avail: US Patent Office CSCL 20D

A method of observing and recording the flow pattern made by a gas moving within a narrow space such as the lubrication gap of a gas bearing is described. A thin film of oil of a special type to give color contrast is applied to the surface of a component (such as a gas bearing component) over which gas is to pass as it flows through a narrow passage. The component is then assembled into the device under study and gas under normal operating pressure is passed through the gas flow passages of the device for an appropriate period of time after which the oil treated component is removed from the assembly. A color photograph is made of the oil covered surface over which the gas has flowed. The interference colors in the light reflected from the oil film vary with the variations in the oil film distribution caused by forces exerted on the oil film by the gas flow. The distribution of the oil film corresponds to the flow pattern of the gas. Official Gazette of the U.S. Patent Office

N71-20831# Thiokol Chemical Corp., Huntsville, Ala.
PARTICLE DISPERSION STUDY Final Report, 25 Aug. 1969 – 30 Jun. 1970
O. R. Pritts Oct. 1970 59 p refs
(Contract F44620-68-C-0049)
(AD-717217; AFOSR-70-2713-TR) Avail: NTIS CSCL 20/4

The program involved experimental observation of dispersion phenomena when particulate matter contained in a subsonic turbulent jet mixes coaxially with another subsonic stream. Experimental variables included particle size, particle flow rate, gas flow rate, and jet molecular weight. Primary gas (e.g., air or helium) entraining the particulate matter was introduced on the centerline of a secondary chamber in which a subsonic turbulent air stream had been established. Particle concentrations at discrete radial and axial locations in the mixing zone were determined. Also when helium was used in the primary stream, helium concentration in the mixing zone was determined. Results showed that the 1 micron diameter particles diffuse at the same rate as the central jet when the central jet is air. Changing the central jet carrier gas from air to helium did not effect particle diffusion rates as predicted by most current theories which assume that particle transport is dependent

upon gas momentum transport. Conversely, these data show that particle transport is independent of gas momentum transports. Results using glass beads showed very high diffusion rates, adverse to that expected. It is postulated that this rapid diffusion is due to an electrostatic field established by interaction between the beads themselves and between the beads and plastic chamber walls. Author (GRA)

N71-20896* Stanford Research Inst., Menlo Park, Calif.
MERCURY CAPILLARY INTERRUPTER Patent
Clarence H. Heckler, inventor (to NASA) Issued 22 Aug. 1967 (Filed 11 Feb. 1965) 4 p Cl. 321-48 Sponsored by NASA
(NASA-Case-XNP-02251; US-Patent-3,337,790; US-Patent-Appl-SN-432030) Avail: US Patent Office CSCL 20D

An interrupter is described which consists of a capillary tube, filled with current-conducting liquid, such as mercury, with electrodes on opposite ends of the tube, for connecting the interrupter to associated circuitry. When current flows between the electrodes through the liquid, the liquid tends to heat up, vaporizing at about the center of the capillary tube, and thereby interrupting the flow of current. Upon the interruption of the flow of current, the vapor, trapped within the tube between liquid sides, condenses back to liquid form to provide a subsequent continuous path for current flow. The rate of interruptions is a function of the properties of the current-conducting liquid, the magnitude of the current, and the dimensions of the capillary tube.
Official Gazette of the U.S. Patent Office

N71-20897# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
RATE-CONTROLLED PARTIAL-EQUILIBRIUM METHOD FOR TREATING REACTING GAS MIXTURES
James C. Keck and David Gillespie (Ill. State Univ.) Jan. 1971 16 p refs
(Grant PHS-1-R01-AP-01228-01)
(FML-71-2) Avail: Issuing Activity

A rate-controlled partial-equilibrium method for treating reacting gas mixtures was developed which is simpler than the usual technique of integrating the full set of rate equations. The method is based on the observation that a rate-controlling reaction is equivalent to a passive constraint on the gas and that the corresponding partial-equilibrium state can be calculated by minimizing the appropriate free energy function. An example illustrating the application of the method to the freezing of threebody reactions in an internal combustion engine is given. Author

N71-20949*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
CONVECTIVE INSTABILITY OF A POLYTROPIC LAYER IN A MAGNETIC FIELD AND A CORIOLIS FORCE
Kin-Wai Yeung Washington Mar. 1971 25 p refs
(NASA-TN-D-6248; MSC-S-260) Avail: NTIS CSCL 20D

An infinite horizontal thin polytropic layer, heated from below and subjected to uniform magnetic field and rotation, is investigated. Rayleigh numbers defining the onset of instability are computed. For a small rotation rate, the presence of a magnetic field increases the stability. For a relatively large rotation rate, increasing magnetic field decreases the stability until a minimum value of Rayleigh number is reached. From that point, the presence of a magnetic field increases the stability. Author

N71-21014# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
NUMERICAL ANALYSIS OF THE VISCOUS SUPERSONIC BLUNT BODY PROBLEM, PART 1
Gino Moretti and Manuel D. Salas Nov. 1970 61 p refs
(Contracts Nonr-839(34); N00014-67-A-0438-0009)
(AD-716775; PIBAL-70-48) Avail: NTIS CSCL 20/4

A time-dependent technique developed by the senior author for inviscid blunt body flows has been extended to compute blunt body flows with fully developed viscous effects. The Navier-Stokes equations are used. To maintain accuracy, the (nonlinear) mesh spacing is adjusted automatically to the nature of the velocity distribution between shock and body. In this way, a wide range of Reynolds numbers can be scanned. The technique proves to be very good in a range of Reynolds numbers between 100 and 100,000. In part I, only results with constant viscosity are presented.
Author (GRA)

N71-21080*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VELOCITY AND TEMPERATURE PROFILES IN NEAR CRITICAL NITROGEN
Robert J. Simoneau, James C. Williams (N.C. State Univ., Raleigh), and Robert W. Graham [1971] 13 p refs Proposed for presentation at Natl. Heat Transfer Conf., Tulsa, Okla., 15–18 Aug. 1971, sponsored by ASME
(NASA-TM-X-52988) Avail: NTIS CSCL 20D

Boundary layer velocity and temperature profiles were measured in nitrogen near its thermodynamic critical point flowing turbulently upward over a heated flat plate with constant surface heat flux. The measurements were made with a combination thermocouple and pitot-static probe. Data were taken with the fluid in the boundary layer spanning the critical temperature and also at the same operating conditions except with the boundary layer at temperatures away from the critical temperature. These results showed that the near critical velocity profiles were quite different, exhibiting a maximum between the wall and free stream. The near critical profile had a much larger Grashof number suggesting that a strong body force effect was present. The data are examined in terms of the velocity and temperature profile response to variations in the system parameters. Proximity to the critical point appears to exaggerate body forces even at quite high Reynolds numbers.
Author

N71-21089* McDonnell Aircraft Corp., St. Louis, Mo.
APPARATUS FOR PURGING SYSTEMS HANDLING TOXIC, CORROSIVE, NOXIOUS AND OTHER FLUIDS Patent
Wilbur E. Gehring and Ronald F. Hellmann, inventors (to NASA) Issued 18 Jul. 1967 (Filed 15 May 1963) 3 p Cl. 141-91 Sponsored by NASA
(NASA-Case-XMS-01905; US-Patent-3,331,404; US-Patent-Appl-SN-280580) Avail: US Patent Office CSCL 20D

A fluid transferring apparatus is described for purging toxic, corrosive, noxious, and other fluids and fumes from materials handling or conduit systems for equipment cleansing and personnel safety. The system is based on the injection of inert fluids into the equipment to be purged in counter flow relation. The purging medium may be gaseous nitrogen, helium, argon, or air under 5 to 500 psi. Diagrams of the purging system including storage tanks, receiving containers, and connections are outlined. J.M.

N71-21114*# Air Force Weapons Lab., Kirtland AFB, N.Mex.
A COMPUTATIONAL METHOD FOR UNIFIED SOLUTIONS TO THE INVISCID FLOW FIELD ABOUT BLUNT BODIES
Ronald H. Aungier *In* NASA Langley Res. Center The Entry Plasma Sheath and its Effect on Space Vehicle Electromagnetic Systems, Vol. 1 1970 p 241–260 refs (See N71-21101 10-25)
Avail: NTIS HC $9.00/MF $0.95

A computational method is presented for exact, direct, and unified solutions to the supersonic blunt body problem. An explicit finite difference scheme for the time-dependent method is developed which uses stabilizing terms of variable magnitude. This insures that the influence of these terms on the solution can be established negligibly small. Major reductions in the computation time and computer storage required for time-dependent solutions

are realized by staging the solution in discrete flow field segments. Results for two-dimensional, axisymmetric, and three-dimensional flows are compared with accepted numerical solutions and experimental data. Author

N71-21127*# General Electric Co., Philadelphia, Pa.
THE IONIZED STAGNATION REGION FLOW AT LOW REYNOLDS NUMBER
H. Low *In* NASA. Langley Res. Center The Entry Plasma Sheath and its Effects on Space Vehicle Electromagnetic Systems, Vol. 1 1970 p 509–529 refs (See N71-21101 10-25)
Avail: NTIS HC$9.00/MF$0.95 CSCL 20D

A study is made of the low Reynolds number viscous flow including the merged layer region for a chemically reacting gas of dissociated and ionized air species at the stagnation region of blunt bodies. Use of a two layer model allowed the inclusion of the effects of heat transfer, shear stress, and heat conduction at the shock. In particular, the electron density in this nonequilibrium regime was obtained. Results indicate that the production of electrons in the low density regime is still appreciable. Comparison with experimental data tends to indicate that the overall combined scheme of chemical rate constants, species transport, and diffusion properties is a reasonable one. Author

N71-21138# Ecole Nationale Superieure de Mecanique, Nantes (France).
EXPERIMENTAL MEASUREMENT OF THE FRICTION MOMENT OF A CYLINDER ROTATING IN A FIXED CYLINDER FOR SMALL GAPS AND HIGH REYNOLDS NUMBERS [MESURE EXPERIMENTALE DU COUPLE DE FROTTEMENT D'UN CYLINDRE TOURNANT DANS UN CYLINDRE FIXE POUR DE FAIBLES ENTREFERS ET DES GRANDS NOMBRES DE REYNOLDS]
P. Sulmont and P. L. Bourget *In its* Ann. of Mech. Semiann. Rept., 1969 p 127–134 refs In FRENCH Prepared jointly with Soc. Brissonneau et Lotz (See N71-21133 10-32)
Avail: NTIS

For the study of turbomachines immersed in water previous works on the friction moment of a cylindrical body rotating in a fixed cylinder are assessed and extended to high Reynolds numbers. The influence of the value of the Reynolds number and of the size of the gap is discussed. ESRO

N71-21139# Ecole Nationale Superieure de Mecanique, Nantes (France).
STUDY OF A JET FROM A CONVERGENT NOZZLE [ETUDE D'UN JET ISSU D'UN CONVERGENT]
P. Guevel, A. Belval, B. Grollesu, and J. Pouplard *In its* Ann. of Mech. Semiann. Rept., 1969 p 135–147 refs In FRENCH (See N71-21133 10-32)
Avail: NTIS

The flow of an ideal fluid in a cylindrical duct terminated by a convergent nozzle is discussed. Theoretical procedures dealt with one dimensional flow whereas the experimental effort concentrated on two dimensional flow. Comparison is made of the flow characteristics with those of a duct terminated with a diaphragm. ESRO

N71-21188# Harry Diamond Labs., Washington, D.C.
FLUERICS. 29: TRANSIENT RESPONSE OF SOME FLUERIC COMPONENTS TO STEP WAVES AND APPLICATION TO MATCHING
Jorma R. Keto Sep. 1970 67 p refs
(AD-717247; HDL-TR-1531) Avail: NTIS CSCL 13/7

Experimental results are shown which verify predicted response characteristics of terminations of transmission lines. Idealized, simple theory is used to determine matching conditions and reflections when not matched. Orifice termination, branch circuits, and change of transmission line cross section are considered. Special apparatus and circuits are described for making the necessary measurements: These include (1) a step-wave generator, (2) a transducer adaptor, (3) a wave bridge, (4) a variable tap, (5) a probe shifter, (6) flow dividers, and (7) a specially modified solenoid valve. Author (GRA)

N71-21226# Royal Aircraft Establishment, Farnborough (England).
ON THE GENERATION OF SOUND RESULTING FROM THE PASSAGE OF A TURBULENT AIR JET OVER A FLAT PLATE OF FINITE DIMENSIONS [ZUR SCHALLERZEUGUNG DURCH EINEN TURBULENTEN LUFSTRAHL UEBER EINER ENDLICH GROSSEN EBENEN PLATTE]
F. R. Grosche Oct. 1970 110 p refs Transl. into ENGLISH of Mitt. Max-Planck-Inst. Stromungsforsch. Aerodyn. Versuchsanstalt (Gottingen), no. 45, 1969
(RAE-Lib-Trans-1460) Avail: NTIS

The generation of sound by a jet of air of high subsonic velocity, issuing from a slot nozzle and passing over a rigid, flat plate of finite dimensions was investigated. Configurations of this type are of interest in, among other fields, the screening of the jet noise from jet installations. Accordingly, the plate is also termed a shield. The relevant basic concepts of aerodynamic sound generation and a description of the measurements made are presented. In particular, the following points have been investigated: (1) the dependence of the acoustic far field on the shield length; on the distance between the jet axis and the shield, and on the jet velocity and (2) the sound source distribution in the turbulent jet, both with and without a shield. Additional sound is generated in the neighborhood of the trailing edge of the shield, when the distance between the shield and the jet axis is small - that is, when the jet is immediately adjacent to the shield. This part of the sound can be attributed to the radiation from a distribution of acoustid dipoles which are produced by the turbulent pressure fluctuations on the shield surface. The quadrupole radiation of the free turbulence is reduced by the shield. Author

N71-21235 California Univ., Berkeley.
SUPERSONIC LAMINAR BOUNDARY LAYER SEPARATION NEAR A COMPRESSION CORNER
Abdallah Antoun Sfeir (Ph.D. Thesis) 1969 86 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 70-6221

Different models were tested permitting variation in the angle of compression and the conditions downstream of reattachment. The heat flux and the resistance of equilibrium of a hot wire anemometer at any location in the flow field were measured. These measurements were supplemented by either the wall of the pitot pressure to compute all thermodynamic and dynamic variables. The results permitted verification of the hypothesis of zero normal pressure gradients when the compression angle is small and the boundary layer is laminar. The enthalpy in the separated bubble was constant and equal to the wall enthalpy of a flat plate with attached laminar boundary layer at the same Mach number. Evidence of a reversed flow with velocities approximately 5% of the free stream velocity was observed. The recompression along the separating streamline was found to be very nearly isentropic. Critical points were located in the reattachment region and a physical explanation proposed, with special emphasis on the location of transition. Dissert. Abstr.

N71-21269 California Univ., Berkeley.
A NUMERICAL METHOD FOR CALCULATING STEADY UNSYMMETRICAL SUPERSONIC FLOW PAST CONES
Daniel Ejike Ndefo (Ph.D. Thesis) 1969 85 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 70-6175

Telenin's numerical method is adapated to the problem of steady supersonic flow past pointed conical bodies at yaw. The method is formulated for cones of circular cross-sections with the intention of determining bounded analytic solutions uniformly valid in the region between the shock and cone surfaces. Attention is focused on the nature of the entropy field and the behavior of the streamlines as influenced by variations in the free-stream conditions. As an example, numerical computations are carried out for flow past a circular cone of semi-apex angle 20 deg yawed at angles of attack varying from 0 deg to 20 deg with respect to a free-stream of Mach number 3.53. Solutions are compared with experimental results and with solutions based on other numerical methods. The entropy layer is shown to be very thin at small angles of attack but relatively thick at large angles of attack. The directions from which the streamlines enter the vortical singularity are found to depend on the angle of attack. Dissert. Abstr.

N71-21272 California Univ., Berkeley.
STUDY OF THE TURNING OF A HIGH REYNOLDS NUMBER INCOMPRESSIBLE FLOW AROUND A SHARP CORNER
Un-chul Paek (Ph.D. Thesis) 1969 91 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 70-6186

The region around the sharp corner in laminar viscous flow is studied for high Reynolds number. In order to avoid handling the full Navier-Stokes equations, the flow variables are expressed in the form of the asymptotic expansions, the first terms of which are solutions to separate local governing equations for each region. To reduce the computational details the Blasius boundary layer approaching the corner is approximated by a simple shear flow. The rotational inviscid flow region surrounding the corner becomes a well-posed boundary value problem for an elliptic partial differential equation. The thin viscous sub-layer, lying inside the rotational inviscid region, can be solved by Thwaites approximate method to calculate such parameters as skin frictin and momentum thickness. In the immediate vicinity of the corner point Weinbaum's theory is used to investigate the nature of the flow. Dissert. Abstr.

N71-21281 California Univ., Berkeley.
AN EXPERIMENTAL INVESTIGATION OF THE SHOCK STRUCTURE IN A PARTIALLY IONIZED GAS
Robert Henry Kirchoff (Ph.D. Thesis) 1969 111 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 70-6143

Shock structure experiments were carried out in a radio frequency heated, steady state, low density, partially ionized argon plasma jet. The primary diagnostic tool was the aligned cylindrical free molecule Langmuir probe used to probe a normal shock wave. Spatial resolution was 13% of the heavy particle shock thickness, thus details of electron temperature, ion number density, and plasma potential are available through the shock. The electron temperature rise was observed to precede the heavy particle shock. The plasma potential converted from floating potential according to the theory of Laframboise was in substantial agreement with changes in plasma potential obtained from a numerical quadrature of the generalized Ohm's law assuming zero current. A quantitative explanation of the dark space observed to precede partially ionized gas shocks is provided by comparing the collisional-radiative recombination rate calculated with observed electron temperature and number density to the luminosity of the flow. Dissert. Abstr.

N71-21282 Virginia Polytechnic Inst., Blacksburg.
STABILITY ANALYSIS OF TRANSITION FROM LAMINAR TO TURBULENT FLOW DURING TWO-PHASE FILM BOILING ON A VERTICAL SURFACE
Henry Son-Jen Kao (Ph.D. Thesis) 1969 205 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 70-5357

The transition from laminar to turbulent flow in the vapor layer of a liquid during film boiling from a vertical flat plate is analyzed by numerical integration of the Orr-Sommerfeld equations. For a given set of physical conditions, the laminar boundary-layer equations for the vapor and the liquid regions are solved. The resulting velocity profiles are used as the basic-flow velocity profiles on the Orr-Sommerfeld equations, and a numerical method is used to find the characteristic values. Both the basic-flow boundary-layer equations and the disturbance equations account for the shear stress, mass transfer, and velocity continuity at the vapor-liquid interface as well as zero velocity conditions at the heated wall and at infinite distance from the wall. The results are presented graphically for particular film-boiling conditions, and the effects of varying the fluid properties are given. Dissert. Abstr.

N71-21283 Texas Technological Coll., Lubbock.
AN EXPERIMENTAL INVESTIGATION OF HEAT TRANSFER AND FRICTION IN A CIRCULAR TUBE FOR LAMINAR FLOW OF AIR UNDER CONDITIONS OF LARGE TRANSVERSE TEMPERATURE GRADIENTS
James Larry Chance (Ph.D. Thesis) 1969 180 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 70-1466

Laminar gas flow in a circular tube with constant wall temperature boundary conditions is investigated experimentally. Emphasis is placed on measurements in the thermal entrance region and on high heat flux levels, where there is a large variation in the fluid properties. Entering Reynolds numbers range from 930 to 2192, and wall-to-bulk temperature ratios exceeding 2.2 are obtained. Detailed velocity and temperature profiles are measured at various axial positions by traversing an impact tube and a thermocouple probe across the gas stream. The heat flux to the gas, utilized in local Nusselt number determinations, is calculated directly from the integrated profiles. Local values of friction factors are obtained by measuring the axial pressure drop with wall static taps and by calculating the changes in the momentum flux directly from the profiles. Recommended design correlations for both the heat transfer and friction are expressed in terms of their corresponding constant property values and the wall-to-bulk temperature ratio. Dissert. Abstr.

N71-21303*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A LINEARIZED APPROACH TO CHEMICALLY GENERATED WAVES IN A DILUTE, ISOTHERMAL ATMOSPHERE
Igor J. Eberstein and Kenneth D. Shere Feb. 1971 22 p refs Submitted for publication
(NASA-TM-X-65478; X-651-71-79) Avail: NTIS CSCL 20D

The characteristics of chemically generated waves in a dilute, isothermal atmosphere are discussed. The major chemical systems are tied to the absorption of ultraviolet radiation from the sun and have a dawn to dusk dependence. There is also a dependence on solar activity. Large storms and phenomena such as aurorae may also be simulated by a chemical type heat release. Continuity and momentum equations are presented. Author

N71-21308*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
VIBRATIONAL RELAXATION AND RADIATIVE GAIN IN EXPANDING FLOWS OF ANHARMONIC OSCILLATORS
Robert L. McKenzie Washington Mar. 1971 25 p refs
(NASA-TN-D-7050; A-3789) Avail: NTIS CSCL 20D

The set of master rate equations for the vibrational relaxation of mixtures of anharmonic diatomic gases in supersonic nozzle expansions is integrated numerically. Large deviations from a Boltzmann distribution of vibrational state population are predicted, particularly when vibrational energy is exchanged between two near-resonant diatomic species. Radiative gain coefficients for

nonequilibrium vibration-rotation transitions are also computed and positive gains, sufficient to support laser oscillations, are predicted for CO-N2 and CO-N2Ar admixtures. Author

N71-21315# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France.)
EQUILIBRIUM THEORY OF SIMPLE LIQUIDS
L. Verlet and J. J. Weis Feb. 1971 55 p refs
(LPTHE-71/5) Avail: NTIS

The perturbation theory of liquids developed by Weeks, Chandler, and Anderson is examined in detail: each assumption is tested by comparison with exact computer results. It is shown that the basic assumptions of WCA are justified. An improved expression for the radial distribution function of the hard sphere gas enables corrections for some further inconsistent assumptions of the WCA theory to be made. Simple analytical expressions are given for the thermodynamic functions of the Lennard-Jones fluid shown to be quite good at high density. It is shown that the remainder of the perturbation series, which converges slowly at lower density, can be evaluated with the help of the Percus-Yevick equation. Finally the original WCA theory is expressed in an analytical form. Author

N71-21330*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REAL GAS EFFECTS IN THE FLOW OF METHANE AND NATURAL GAS THROUGH CRITICAL FLOW NOZZLES
Robert C. Johnson 1971 16 p refs Proposed for presentation at Transmission Conf., Houston, Tex., 17–18 May 1971; sponsored by Am. Gas Assoc., Inc.
(NASA-TM-X-52994; E-6235) Avail: NTIS CSCL 20D

Equations for the mass flow rate of methane and nineteen natural gas mixtures through critical flow nozzles were established, including real gas effects. For these calculations, the Benedict-Webb-Rubin state equation was used. The data are presented so that the mass flow rate can be determined for most natural gases whose composition is known. In addition to the methane calculations based on the Benedict-Webb-Rubin state equations, methane calculations based on a recent and more accurate state equation are presented. In all cases, the calculations are for pressure to 69 × 100,000 N/sq m (1000 psia) and temperatures from 250 to 390 K. Author

N71-21335 California Univ., San Diego.
GAS DYNAMIC STUDIES OF DESORPTION RATES
Scott Stephen McElmury (Ph.D. Thesis) 1969 249 p
Avail: Univ. Microfilms: HC $11.25/Microfilm $3.25 Order No. 70-5910

A summary of research is presented. A brief description is given of the general nature of physical adsorption and desorption and many related definitions and concepts are introduced. The development is reviewed of a gas-dynamic technique for the study of desorption rates in one-component gas systems. The technique was found to be useful for the determination of desorption rates from porous solid particles under isothermal conditions. In addition, theoretical expressions for diffusion-controlled desorption were developed for the rate of desorption under the experimental conditions. Recent studies are described which extend the gas-dynamic technique to two-component mixtures. For mixtures containing one absorbed and one nonadsorbed component, the required analysis and experimental measurements are very similar to those required for one-component systems. For gas mixtures in which significant adsorption of both constituents occurs, spectroscopic analyses must be performed in order to define the desorption process completely. Dissert. Abstr.

N71-21336 University of Southern Calif., Los Angeles.
EVAPORATION FROM A SPHERICAL SOURCE INTO A VACUUM OR INTO A PURE VAPOR UNDER STRONG NONEQUILIBRIUM CONDITIONS
Robert Lee Collins (Ph.D. Thesis) 1969 267 p
Avail: Univ. Microfilms: HC $12.15/Microfilm $3.45 Order No. 70-5203

When a stationary spherical liquid drop and its encompassing vapor cloud are strongly out of equilibrium the rate of evaporation is nonzero and is directly influenced by molecular collisions occurring in the vapor cloud. The purpose of the study is to estimate this effect when the mean free path in the vapor cloud is small compared to the drop radius. The first problem considered is the evaporation of a droplet into a vacuum where the resulting vapor cloud is formed by emitted molecules. The second spherical source problem studied concerns a droplet immersed in its own vapor. These two distinct problems can be split into two parts: the boundary conditions at and the gas flow away from the drop surface. Surface boundary conditions analogous to those used in slip flow are developed for both a monatomic and a diatomic gas. In considering a diatomic gas, rotational equilibrium is assumed and Eucken's approximation is used. Dissert. Abstr.

N71-21342*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PHYSICS
In its Space Programs Sum. No. 37-66, Vol. 3, Oct.–Nov. 1970 31 Dec. 1970 p 13–17 refs (See N71-21338 10-30)
Copyright. Avail: NTIS CSCL 20D

Two computer programs, one for the inviscid flow theory and the other for the viscous flow theory, were modified for calculating the boundary layer response on a model in the supersonic wind tunnel to sound waves generated by turbulent boundary layers on the tunnel side walls. In the inviscid theory, the steady state response to a forcing function (the external pressure field) is calculated by adjusting amplitude and phase of the reflected wave to satisfy the boundary conditions at the wall; the equations are then integrated again from the free stream to the wall to form the solution. In the viscous theory, the eight first-order equations are integrated from the free stream to the wall for the three viscous solutions which go to zero along with the incoming and reflected wave solutions. Also considered is the use of generators of the invariance group of a given set of equations to formulate a solution for partial differential systems. G.G.

N71-21385 Ohio State Univ., Columbus.
RADIATIVE TRANSFER, CHEMICAL NONEQUILIBRIUM, AND TWO TEMPERATURE EFFECTS BEHIND A REFLECTED SHOCK WAVE IN NITROGEN
Leland Arnold Carlson (Ph.D. Thesis) 1969 167 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 70-6741

The fundamental equations and boundary conditions governing the flow between a reflected shock wave and a shock tube end-wall were formulated. The results show that in the region immediately behind the shock wave the electron temperature is much lower than the heavy particle temperature, but that near the wall the two temperatures are equal after 0.45 sec. During the first microsecond after reflection radiative cooling is strong enough to cause the end-wall pressure to decrease by a factor of almost two before increasing to its equilibrium value. This cooling also induces a velocity acceleration towards the wall and accelerates chemical and thermal relaxation. The atom-electron reaction is shown to be the predominant ionization mechanism except near the shock front, where atom-atom ionization is important. Finally, comparison calculations demonstrate that two temperature effects must be included to accurately predict end wall radiative heat transfer rates and radiative-gasdynamic coupling effects. Dissert. Abstr.

N71-21447# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
MOVEMENT OF SMALL GAS BUBBLES IN A SMOOTHLY DECELERATING LIQUID

Subba Rao Gutti Mar. 1971 29 p refs Submitted for publication
(RM-499J) Avail: NTIS

The time-dependent motion of small gas bubbles in decelerating liquid was studied. An expression for the bubble slip is described as a function of gamma, a parameter that denotes the ratio of the pressure and viscous interaction forces. The bubbles' asymptotic slip value varies from zero at gamma = 0 to a limiting value of minus one as gamma approaches limit of - f(Re), where f(Re) is a correction factor to Stokes drag coefficient. Author

N71-21600# Catholic Univ. of America, Washington, D.C. Dept. of Space Science and Applied Physics.

THREE DIMENSIONAL PLANING AT HIGH FROUDE NUMBER Final Report

D. P. Wang and Paul Rispin 19 May 1970 34 p refs
(Contract N00014-67-A-0377-0006)
(AD-717067; Rept-70-003) Avail: NTIS CSCL 13/10

The steady motion of a planing surface of moderate aspect ratio at small angles of attack is considered. Linearized theory is used with a square-root type of pressure singularity representing the flow near the leading edge. As asymptotic solution for the pressure distribution on the planing surface at large Froude number (or small beta, the inverse of the Froude number) is sought. The lowest order term of the pressure distribution, obtained by setting beta equal to zero, is found to be the same as the pressure distribution on the lower side of the corresponding thin wing. Higher order terms in beta are obtained by an iteration process. Explicit solutions are obtained to order beta squared for rectangular planforms. Numerical results are calculated for rectangular flat plate planing surfaces of aspect ratios from 0.5 to 2.0. It is found that for large aspect ratios the lift coefficient is reduced by the gravity effect and for small aspect ratios it is increased, the dividing aspect ratio being about 1.5. The results compare reasonably well with experimental data. Author (GRA)

N71-21613# Virginia Polytechnic Inst., Blacksburg. Dept. of Engineering Mechanics.

LONGITUDINAL CURVATURE AND DISPLACEMENT SPEED EFFECTS ON INCOMPRESSIBLE BOUNDARY LAYERS

Michael J. Werle and Stephen F. Wornom Dec. 1970 92 p refs
(Contract N00014-70-C-0024)
(AD-717071; VPI-E-70-24) Avail: NTIS CSCL 20/4

The title problem is considered for the case of flow past a circular cylinder placed normal to a uniform mainstream with Reynolds numbers from 40 to 200. Implicit finite difference numerical solutions are obtained for a set of boundary-layer equations that take account of the second order effects associated with surface curvature and displacement speed. It was found that both of these contributors have a significant influence on the internal structure of the viscous region and that an accurate estimate of the surface pressure distribution is essential for estimating the surface shear stress. Author (GRA)

N71-21623# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Flight Dynamics Lab.

CRITICAL EVALUATION OF A NONUNIFORM FLOW SONIC BOOM REDUCTION CONCEPT Technical Report, Oct. 1968–Jul. 1969

Thomas M. Weeks Sep. 1970 37 p refs
(AD-717193; AFFDL-TR-70-65) Avail: NTIS CSCL 20/1

An investigation was made of a nonuniform flow field sonic boom elimination device. The two-dimensional flow field consists of a slit jet impinging on an inclined flat plate airfoil. The report presents independent analyses of the problem as well as a critique of the analysis. The major finding is that one can expect no more than a 10% reduction in the strength of the leading edge shock wave at a thousand chord lengths from the plate when compared to the corresponding case without jet flow (same chord and lower surface pressure). Under identical conditions, a 20% reduction is found. Author (GRA)

N71-21642# Woods Hole Oceanographic Institution, Mass.

GEOPHYSICAL FLUID DYNAMICS. VOLUME 1: COURSE LECTURES AND ABSTRACTS OF SEMINARS Notes on the 1970 Summer Study Program

Nov. 1970 129 p refs
(Grant NSF GZ-1494)
(PB-196589; WHOI-Ref-70-50-Vol-1) Avail: NTIS CSCL 03B

Contents: Flow in rotating stratified systems; Ekman layer in a stratified, rotating fluid; Vertical boundary in a rotating, stratified flow; Axially symmetric circulation in an annulus; Linear stability of the symmetric flow; Quasi-geostrophic potential vorticity equation inviscid linear problem; Linear Stability of the symmetric flow (viscous theory); Nonlinear stability of the symmetric flow inviscid case; Instabilities of convection rolls in a high Prandtl number fluid; On the earth's core-mantle interface; The periods of finite-disk generated gravity waves; Soap films; Inertial Taylor columns; Venus; The greenhouse that ran away; Turbulent bursts; and Turbulent shear flow structure. GRA

N71-21643# Woods Hole Oceanographic Institution, Mass.

GEOPHYSICAL FLUID DYNAMICS. VOLUME 2: FELLOWSHIP LECTURES Notes on the 1970 Summer Study Program

Nov. 1970 150 p refs
(Grant NSF GZ-1494)
(PB-196590; WHOI-Ref-70-50-Vol-2) Avail: NTIS CSCL 03B

Contents: Effect of a sloping botton on a rotating fluid; Stability of a rotating, inclined layer of fluid heated from below; The rotation of venus and thermal tides; A two-layer ocean model; Stratified rotating flow around an island; Vortex rings and density interface; Temperature modulated convection; A thermally driven western boundary current; and Viscous destabilization of the Kelvin-Helmholtz instability. GRA

N71-21646# Joint Publications Research Service, Washington, D.C.

THE ROLE OF VORTEX FORMATION ON LOCOMOTION OF FISH, AND THE INFLUENCE OF THE BOUNDARY BETWEEN TWO MEDIA ON THE FLOW PATTERN

Yu. G. Aleyev et al 2 Apr. 1971 11 p refs Transl. into ENGLISH from Zool. Zh. (Moscow), v. L, no. 2, 1971 p 228–234
(JPRS-52790) Avail: NTIS

The visualized flow patterns are discussed for three species of pelagic fish: Trachurus mediterraneus ponticus Aleev, Spicara smaris (L.), and Chalcalburmus chalcoides Berg, in the range of Re values from 60,000 to 240,000. A continuous streamline body was established for all the fish. The influence of respiration on instability of the flow pattern is discussed. It was demonstrated that the closeness of the boundary between two media (water and air) which distorts the true flow pattern has an effect; in this instance large vortices are formed about the body of the fish which are related to the general disruption of the boundary layer. Author

N71-21705# Rutgers Univ., New Brunswick, N.J. Dept. of Mechanical and Aerospace Engineering.

SEPARATED FLOWS Annual Report, 1 Sep. 1969–31 Aug. 1970

Robert H. Page Sep. 1970 90 p refs
(Contract F44620-68-C-0018; Proj. Themis)
(AD-717200; RU-TR-135-MAE-F; AFOSR-70-2514TR) Avail: NTIS CSCL 20/4

A brief review of the Project THEMIS research program in separated flows is presented. The following projects were under way: smooth wall separation in oscillating flow, turbulent subsonic

axisymmetric wake, supersonic axisymmetric near-wake, non-equilibrium processes in separated flow, numerical methods for free shear layer problems, flow reattachment, and subsonic oscillating flow over a backstep. The personnel involved and progress are given for each project. Other important developments are briefly reported. Author (GRA)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N71-20613# Bureau of Mines, Washington, D.C.
HEAT CONTENT AND SPECIFIC HEAT OF SIX ROCK TYPES AT TEMPERATURES TO 1000 C
David P. Lindroth and Walter G. Krawza Apr. 1971 27 p refs
(BMRI-7503) Avail: Issuing Activity

The heat content above 25.0 C up to 1,000 C was measured for six rock types: St. Cloud Gray Grandodiorite, Holston Limestone, Sioux Quartzite, Rockville Quartz Monzonite, Salem Limestone, and the basalt at Dresser, Wis. The calorimetric data were obtained with an isothermal jacket-copper block calorimeter. The experimental heat content data for each rock type are presented, along with specific heat data obtained from the temperature derivative of the heat content. For the six rock types the maximum deviations of the specific heats at a given temperature were within 10 percent below 575 C and within 34 percent above 575 C. The increase in the values of specific heat range from a minimum of 13 percent for the basalt at Dresser, Wis. (temperature range, 100 to 1,000 C) to a maximum of 46 percent for Holston Limestone (temperature range, 100 to 870 C). Author

N71-20618*# Alaska Univ., College. Geophysical Inst.
INVESTIGATION OF SUNLIT AURORA Final Report, 1 Apr. 1969 – 31 Mar. 1970
Gerald J. Romick 31 Mar. 1970 14 p refs
(Grant NGR-02-001-060)
(NASA-CR-117405) Avail: NTIS CSCL 04A

A multifilter scanning photometer was operated on board the 1969 NASA auroral airborne expedition. The experiment was directed towards the acquisition of information on the enhancement of the N2(+) 1NG system through resonant scattering of sunlight and the horizontal distribution within discrete auroral forms of the 5577 OI emission relative to that of the N2(+) 1NG bands under sunlit and midday conditions. Few data on sunlit aurora were obtained but the observations of midday aurora are of special interest due to the paucity of information available regarding their special characteristics, relative emission height variation and general height range. The data were acquired in combination with another experiment using the same instrumentation on the airborne expedition. The operation is summarized and some of the data that were obtained are described. Author

N71-20619# Scientific Research Associates, Inc., Rockville, Md.
FEASIBILITY OF DETECTING OBJECTS BURIED IN THE SEA BOTTOM WITH LOVE WAVES Final Technical Report, 1 Jun. – 31 Oct. 1970
Albert A. Hudimac Nov. 1970 89 p refs
(Contract N00014-70-C-0378)
(AD-717087; Rept-70-1) Avail: NTIS CSCL 17/1

The concept of a system for the detection of objects buried in the ocean bottom using Love waves for irradiation and compressional waves in the sea for detection is described. Previous work is reviewed. An operational system for the embodiment of the concept is presented. A Love wave sonar equation is developed so that the capabilities of the system can be treated in an orderly fashion. The source level and (loss-less) propagation are analyzed rigorously for a simple model of the ocean bottom. The scattering by the target and the absorption of Love waves are treated more approximately. It is asserted that it is feasible to detect objects in the bottom of the sea by a Love wave system at ranges that would be of interest in operational situations. Qualitative arguments are presented on the basis of analyses done and on the basis of results in the technical literature; quantitative proof requires additional calculations and analyses, as well as better empirical knowledge of Love wave absorption and scattering from imperfections in ocean bottom strata. Author (GRA)

N71-20620# California Univ., San Diego. Scripps Inst. of Oceanography.
PALEOMAGNETISM AND PLATE TECTONICS
Jean Francheteau 1 Nov. 1970 347 p refs
(Contract N00014-69-A-0200-6002)
(AD-717089; MPL-U-60-70; SIO-Ref-70-30) Avail: NTIS HC $8.00/MF $0.95 CSCL 8/7

Paleomagnetism and plate tectonics are combined in a new procedure for producing paleogeographic reconstructions of the evolution of present day world geography from proto-continents. For each geologic epoch, the continents are first subjected to rotations relative to each other from the data of plate tectonics, then another rotation is carried out with respect to the Earths spin axis by swinging the virtual paleomagnetic poles to the present north pole in a single rotation. The new method checks Bullards reconstruction of the continents surrounding the Atlantic Ocean which was accomplished by computer fitting of their continental shelves. Author (GRA)

N71-20621# Kiruna Geophysical Observatory (Sweden).
BASIC DATA REDUCTION AND STANDARD PROGRAMMES FOR AN AURORAL-PARTICLE SATELLITE EXPERIMENT
H. Borg, P. Christophersen, and W. Riedler Oct. 1970 30 p refs Sponsored in part by Swed. Nat. Sci. Res. Council and Swed. Board for Tech. Develop.
(KGO-Preprint-70-313) Avail: NTIS

The main lines of reasoning in the organization of the data flow and the final data reduction are described for an auroral-particle satellite experiment, included in the ESRO 1A and 1B scientific payloads. Data acquisition, quick-look data, standard and special programs are briefly discussed. Author (ESRO)

N71-20634# Royal Inst. of Tech., Stockholm (Sweden). Div. of Electron and Plasma Physics.
SIMULTANEOUS ELECTRIC FIELD MEASUREMENTS IN THE AURORAL IONOSPHERE USING THREE INDEPENDENT TECHNIQUES
U. Fahleson, C.-G. Fälthammar, A. Pedersen (ESTEC), K. Knott (ESTEC), B. Brommundt (Heidelberg Univ.) et al Aug. 1970 28 p refs Presented at the Symp. on Upper Atmospheric Currents and Elec. Fields, Boulder, Colo., 17 – 21 Aug. 1970
(Répt-70-25) Avail: NTIS

Two Skylark rockets were launched from ESRO's rocket range near Kiruna on 14 February 1970 at 17:15 and 2 April at 02:46 CET, for investigation of electric fields. Each rocket carried an electric double-probe experiment, a Langmuir probe, an experiment to detect the influence of the plasma drift on the wake of the rocket, a Geiger-Muller experiment, and finally a barium cloud experiment and provided independent information on the ambient electric field. The initial results of these three electric field experiments are dealt with. In the first flight all methods indicated a roughly northerly field of about 22 mV/m. In the second flight (under quiet conditions), a southerly field between 3 and 6 mV/m was observed by the different experiments. Author (ESRO)

N71-20638*# Michigan Univ., Ann Arbor. Dept. of Electrical Engineering.
EMPIRICAL MODEL OF POLAR THERMOSPHERE STORM Final Technical Report
D. R. Taeusch Jan. 1971 31 p refs
(Contract NAS8-26243)
(NASA-CR-103080; Rept-03756-1-F) Avail: NTIS CSCL 04A

Satellite neutral atmospheric composition measurement data are studied for: (1) the latitudinal extent of the neutral response to the storm; (2) the magnitude of the response versus quiet conditions; (3) the longitudinal variations in the auroral oval, and (4) the time responses of the atmospheric parameters to the solar activity as indicated by the solar-geomagnetic indices. Author

N71-20639# Danish Meteorological Inst., Charlottenlund.
MEAN SEA LEVEL AND ITS CHANGES AT THE DANISH COAST [MIDDELVANDSTAND OG DENS AENDRING VED DE DANSKE KYSTER]
Helge Thomsen and Birgit Hansen 1970 26 p refs In DANISH; ENGLISH summary *Its* Meddelelser No. 23
Avail: NTIS

The sea levels are calculated in relation to the levelling datum Dansk Normal Nul (DNN) by levelling to the tide staff at each tide gauge. Normal sea level term and its relation to mean sea level is discussed. The yearly means of the sea level at Esbjerg plotted against time and the equations are given for the determination of normal sea level for a given year in relation to DNN at 10 stations. Finally the seasonal variation of the sea level is discussed and illustrated. Author (ESRO)

N71-20641# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
ON METHODS OF GRAPHICAL DISPLAYING OF POLAR MAGNETIC DISTURBANCES
A. N. Zaitzev (IZMIRAN) and R. Bostroem Nov. 1970 19 p refs
(Rept-70-34) Avail: NTIS

Some simple and useful methods of mapping the field of polar magnetic disturbances are discussed. Contour maps showing the storminess in a local time/universal time plane are used to trace the variation with time of the longitudinal extent and intensity of the auroral electrojets. In effect this kind of map is a way of ascribing to each longitude an index analogous to the AE index. For the study of north-south motions of the auroral electrojets during polar magnetic substorms contour maps are used showing the disturbances of the three field components in a latitude/universal time plane. Author (ESRO)

N71-20657# Technical Univ. of Denmark, Lyngby. Lab. of Electromagnetic Theory.
EXPERIMENTS WITH ELECTROMAGNETIC PROBING OF SEA ICE
P. D. Christoffersen and P. Gudmandsen Oct. 1970 36 p refs Sponsored partly by the Danish Meteorol. Inst. and the Danish Roy. Navy
(R-83) Avail: NTIS

Experiments in probing of sea ice by means of a frequency-modulated radar at 10 GHz are described. The radar was developed and the experiments were carried out in order to test the performance of this rather simple radar system. Two experiments were made, one in northern Sweden including ice on lakes and ice on a sea with a low salinity, and another in fjords and over the sea around Greenland. Both experiments were airborne and were carried out over parts of the routes with a continuous recording of the received signals. A survey of the present knowledge of the dielectric properties of sea ice and a short description of the principle of the FM radar used is given along with examples of recordings showing signals which are interpreted as ice thickness. Author (ESRO)

N71-20679# Joint Publications Research Service, Washington, D.C.
POSSIBILITY OF USING SURFACE-ACTIVE SUBSTANCES FOR MODIFYING CUMULUS CLOUDS
M. M. Kokhanovich 23 Mar. 1971 4 p refs Transl. into ENGLISH from Probl. Fiz. Atm. (Leningrad), no. 6, 1968 p 95–98
(JPRS-52694) Avail: NTIS

Modifications made on cumulus clouds by injecting powdered surface active substances into the warm part of the cloud are discussed. Modification effects are based on the conditions of velocity profiles of ascending currents and other meteorological elements. Conclusions indicate modifications may be made in clouds with vertical development. E.H.W.

N71-20692# California Univ., Livermore. Lawrence Radiation Lab.
COMPUTER CODE FOR THE ANALYSIS OF DIGITIZED SEISMIC SIGNALS
Barry C. Howard 10 Oct. 1970 46 p refs
(UCRL-50939) Avail: NTIS

The ADSS code, a multipurpose tool for the reduction of digitized seismic signal data, is presented. The 48 major functions of the code, subroutines identified and called by number, are described. A sample application of the program to digitized seismic data is included. Author (NSA)

N71-20704# TUAB Teleutredningar A.B., Solna (Sweden). Space Technology Group.
THE SWEDISH TWILIGHT CAMPAIGN AT ESRANGE IN MARCH 1970 Final Report
S. Lundin 19 Nov. 1970 10 p ref
(Rept-S5-360-33) Avail: NTIS

An account is given of the Swedish sounding rocket program using Skua-2 rockets for investigating the electron concentration, electron detachment from negative ions caused by sunlight and the ozone distribution between 35 and 90 km during morning twilight. ESRO

N71-20708*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
ON THE DISTRIBUTIONS OF PLASMAS AND ELECTRIC FIELDS OVER THE AURORAL ZONES AND POLAR CAPS
L. A. Frank and D. A. Gurnett Feb. 1971 56 p refs
(Contracts NAS5-10625; NAS1-8141; NAS1-2973; Grant NGL-16-001-002; Contract N00014-68-A-0196-003)
(NASA-CR-117403; Rept-71-5) Avail: NTIS CSCL 04A

Simultaneous observations of dc electric fields and low energy charged particles at low altitudes over the earth's auroral zones and polar caps were obtained with the satellite Injun 5. These observations are interpreted in terms of a magnetospheric model as deduced from plasma observations in the distant magnetosphere and in terms of essential elements for any credible theory of auroral arcs; in particular, those associated with inverted V precipitation bands. Several of the principal results for the evening and dawn local time sectors are summarized. Author

N71-20712# Oxford Univ. (England). Clarendon Lab.
ENERGY CONVERSIONS AND MEAN VERTICAL MOTIONS IN THE HIGH LATITUDE SUMMER MESOSPHERE AND LOWER THERMOSPHERE
Paul J. Crutzen 1970 37 p refs Sponsored by ESRO
Avail: NTIS

Important stages in the decay of the chemical energy in the upper atmosphere are described and illustrated with theoretical results from a photochemical model for the high latitude summer mesosphere and lower thermosphere. The roles played by oxygen, water, and carbon dioxide in the energy balance are discussed. Author (ESRO)

N71-20737# McGill Univ., Montreal (Quebec). Faculty of Graduate Studies and Research.
MAPPING AND MEASURING SOLAR RADIATION
B. K. Basnayake Nov. 1970 32 p refs
(Contract N00014-68-C-0307)
(AD-716804; TR-2) Avail: NTIS CSCL 4/1

A review of methods to evaluate and map the topographic variations of solar radiation leads to suggestions for improving mapping methods by: (a) using slope facet divisions of an area rather than a grid-system of point location; and (b) mapping heat load on an area rather than intensities. To provide more widespread observations of solar radiation the reliability of simple instruments needs to be tested. Testing in Barbados suggests that a bi-metallic actinograph is a useful all-purpose instrument. Author (GRA)

N71-20793# Cincinnati Univ., Ohio. Dept. of Physics.
RESEARCH IN AIRGLOW PHENOMENA Final Report, 1 Sep. 1969 – 31 Aug. 1970
Tai Fu Tuan 16 Nov. 1970 36 p refs
(Contract F19628-70-C-0034)
(AD-717204; AFCRL-70-0664) Avail: NTIS CSCL 4/1

The report is divided into three parts: The presence of large scale time-dependent dynamic disturbance in the ionosphere may be treated by using an inhomogeneous linear integral equation with Greens function satisfying homogeneous boundary conditions. For the special case where there is no disturbance, the theory reduces to the well known results for a quiet ionosphere. The disturbance of the ionosphere by a long period travelling wave originating in the northern hemisphere has been detected in the southern hemisphere with the accompanying expected phase change as the wave crosses the magnetic equator. A comprehensive survey has been made into the question of anomalous sounds from auroras. Preliminary results seem to show that the theory of brush discharge can properly explain all the observed phenomena without inconsistency. Author (GRA)

N71-20853*# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
MOTION AND STRUCTURE OF THE MAGNETOPAUSE
Michel P. Aubry, Margaret G. Kivelson, and Christopher T. Russell [1970] 70 p refs Sponsored in part by ESRO
(Contract NAS5-9098)
(NASA-CR-117741; Publ-865) Avail: NTIS

On 27th March, 1968, following a reversal of the interplanetary magnetic field from northward to southward, some large amplitude oscillatory motions developed on the magnetosphere boundary; at the same time the very structure of this boundary was very variable and this variability increased with the southward component of the interplanetary field. Associated with these phenomena, variable components of the magnetic field normal to the boundary were recorded and produced a large transfer of momentum across the magnetopause leading to the erosion of the dayside magnetosphere. It must be emphasized that during all this period of time, the observed local characteristics of the boundary, including the amplitude and orientation of the normal component as well as the counting rate of energetic electrons on either side of the boundary, were extremely variable and thus did not fit with any steady open or closed model of the magnetosphere. Author (ESRO)

N71-20854# Meteorologisches Observatorium, Hohenpeissenberg (West Germany).
RESULTS OF AEROLOGICAL OZONE SOUNDINGS AND TOTAL OZONE MEASUREMENTS DURING THE SECOND HALF OF 1969 [ERÉBNISSE DER AEROLOGISCHEN OZONSONDIERUNGEN UND DER GESAMTOZONMESSUNGEN IM 2. HALBJAHR 1969]
Oct. 1970 184 p In GERMAN *Its* Sonderbeobachtungen No. 9
Avail: NTIS

The results of ozone soundings above the Hohenpeissenberg Meteorological Observatory (Germany) are given in the form of tables and graphs. ESRO

N71-20855*# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
ON INWARD MOTION OF THE MAGNETOPAUSE PRECEDING A SUBSTORM
Michel P. Aubry, Christopher T. Russell, and Margaret G. Kivelson 1 Jun. 1970 39 p refs Sponsored in part by ESRO and NASA
(NASA-CR-117442; Publ-846) Avail: NTIS CSCL 04A

On 27th March 1968 the UCLA magnetometer onboard the inbound OGO 5 satellite recorded an inward motion of the magnetopause by about 2 Re in two hours. It is shown that this inward motion was associated with a reversal of the vertical component of the interplanetary field from northward to southward, the solar wind momentum flux remaining constant. The inward shift did not produce any compression of the magnetospheric cavity which implies a transfer of magnetic flux from the dayside magnetosphere to the tail. The growth phase of a substorm was observed less than half an hour following the beginning of the inward motion. It is emphasized that the position of the magnetopause after the inward shift cannot be explained in terms of the available models. Author (ESRO)

N71-20858# Groupe de Recherches Ionospheriques, Paris (France).
MEASUREMENT OF HIGH FREQUENCY WAVE ABSORPTION OVER THE POLAR CAPS USING RIOMETERS. APPLICATION AT THE DUMONT D'URVILLE STATION [LES MESURES D'ABSORPTION DES ONDES H.F. PAR RIOMETRE DANS LES CALOTTES POLAIRES. APPLICATION A LA STATION DUMONT D'URVILLE]
J. Lavergnat Sep. 1970 108 p refs In FRENCH
(GRI-NTP-75) Avail: NTIS

The use of riometers to measure the ionospheric absorption is discussed. Different procedures for routine reduction of riometer charts are reviewed and a new procedure, based on the average distribution of the servodiode current is proposed. Results gained with four riometers at the Dumont d'Urville ionospheric sounding base are discussed. ESRO

N71-20898# Groupe de Recherches Ionospheriques, Paris (France).
AURORAL CIRCUMZENITHAL ARCS AND MAGNETIC PERTURBATIONS AT THE DUMONT D'URVILLE STATION [ARCS AURORAUX CIRCUMZENITHAUX ET PERTURBATIONS MAGNETIQUES A LA STATION DUMONT D'URVILLE]
Martine Gillon 16 Nov. 1970 83 p refs In FRENCH
(GRI-NT-80) Avail: NTIS

Possible relationships between optical and magnetic phenomena observed at the Dumont d'Urville Geophysical Observatory have been investigated. The rotation of circumzenithal auroral arcs, the rotation of the perturbation vector associated with magnetic disturbance, and the rotation of the vector measuring the mean ionospheric current density at the zenith have been considered. It is found that circumzenithal arcs should be considered as being of a different nature to auroral activity. The origin of the former has still to be determined. ESRO

N71-20899# Groupe de Recherches Ionospheriques, Paris (France).
SYNOPSIS OF MAGNETIC FIELD VARIATIONS IN THE POLAR REGIONS [ETUDE SYNOPTIQUE DES VARIATIONS DU CHAMP MAGNETIQUE DANS LES REGIONS POLAIRES]
Christine Guerin 16 Nov. 1970 81 p refs In FRENCH
(GRI-NT-81) Avail: NTIS

A synopsis of ionospheric currents and their variations over the polar caps is presented. Suitability of the methods used to measure the nonperturbated magnetic field at lower latitudes are discussed. A statistical survey of K indices recorded at geophysical observatories located at latitudes ranging from the center of the polar cap to beyond the auroral zones was carried out with special attention being paid to the behavior of the currents at their crossing of the auroral zone. The diurnal variation of this behavior gives some indication of the structure of the auroral oval. ESRO

N71-20906# Raytheon Co., Alexandria, Va. Autometric Operation.
MUSAT 4, VOLUME 1 Final Technical Report, Jun. 1967 – Nov. 1970
Atef A. Elassal, Ronald K. Brewer, Gordon Gracie, and Michael A. Crombie Nov. 1970 159 p refs
(Contract DAAK02-67-C-0592)
(AD-717105; ETL-CR-70-6-Vol-1) Avail: NTIS CSCL 8/2

An efficient, general analytical triangulation program for frame photography was developed and programmed in FORTRAN V for the UNIVAC 1108 computer. The program features a free formatting technique for ease of data input and offers a wide variety of input/output options to cover the needs of both research and production oriented users. Preprocessing of image coordinates, including corrections for film deformation, radial and tangential lens distortion, and atmospheric refraction, is provided in several forms. Blunder and date editing features are incorporated and diagnostic and error messages are given with each phase of the triangulation process. A rigorous least squares adjustment with error propagation facility is provided to handle blocks of virtually unlimited size. The mathematical model, based primarily on the collinearity condition, can be constrained by range measurements between any two points in object space and by groups of points having equal elevation, as well as by conventional ground control. Data weighting is provided, whereby input parameter precision estimates dictate the influence the input parameters will have on the least squares adjustment. The solution of the normal system of equations is accomplished with the AUTORAY algorithm. Author (GRA)

N71-20907# Raytheon Co., Alexandria, Va. Autometric Operation.
MUSAT 4, VOLUME 2: OPERATION MANUAL Technical Report, Jun. 1967 – Nov. 1970
Atef A. Elassal and Ronald K. Brewer Nov. 1970 62 p
(Contract DAAK02-67-C-0592)
(AD-717106; ETL-CR-70-6-Vol-2) Avail: NTIS CSCL 8/2

The manual is intended as a guide to the preparation of photogrammetric data for processing with the MUSAT IV program. The contents of data deck are specified in general and in detail, and the philosophy behind a free format data input system is given. Author (GRA)

N71-20908# Raytheon Co., Alexandria, Va. Autometric Operation.
MUSAT 4, VOLUME 3: A PROGRAM DOCUMENTATION Technical Report, Jun. 1967 – Nov. 1970
Atef A. Elassal Nov. 1970 203 p refs
(Contract DAAK02-67-C-0592)
(AD-717107; ETL-CR-70-6-Vol-3) Avail: NTIS CSCL 8/2

The report contains the documentations for the MUSAT IV Program. In particular, it describes the program structure, external data sets, and the programs and subroutines of the system. Author (GRA)

N71-21009# Joint Publications Research Service, Washington, D.C.
EXTRACTION METHOD OF REGENERATING WATER IN CLOSED ECOLOGICAL SYSTEMS
G. P. Khomchenko et al 23 Mar. 1971 8 p refs Transl. into ENGLISH from Izv. Timiryazev. Sel'Skokhoz. Akad. (Moscow), no. 1, 1971 p 183–188
(JPRS-52696) Avail: NTIS

Water regeneration by the extraction of organic and inorganic impurities in closed ecological systems is discussed. The recovery of water by this method is shown to proceed in the stages of extraction, separation, and recovery of the extractant. A biomedical evaluation of regenerated water with different extractants is included. F.O.S.

N71-21019*# Ohio State Univ. Research Foundation, Columbus. Dept. of Geodetic Science.
GRAVITY FIELD REFINEMENT BY SATELLITE TO SATELLITE DOPPLER TRACKING
Charles R. Schwarz Dec. 1970 141 p refs
(Contract NGL-36-008-093)
(NASA-CR-117404; Rept-147) Avail: NTIS CSCL 08N

Two concepts of satellite to satellite tracking are studied by means of simulated least squares solutions for parameters describing the gravity field. The first concept uses the range rate between two satellites near together in very low orbits. In the second concept, a constellation of very high geostationary satellites track a single satellite in a very low orbit. The experimental results indicate that better resolution of the gravity field can be obtained from two very low satellites. However, satisfactory results can also be obtained when a high geostationary satellite tracks the low satellite. The latter concept is recommended, since it also offers several operational advantages. Because of the loss of detail with altitude, satellite to satellite tracking cannot replace surface gravimetry for extremely detailed local surveys of areas smaller than 200 km squares. Satellite to satellite Doppler tracking can be used in fairly detailed surveys of ocean areas and for surveying the gravity field on a global basis. Author

N71-21047# Royal Netherlands Aircraft Factories Fokker, Amsterdam. Aerospace Dept.
OPERATION OF THE VACUUM UV IRRADIATION TEST FACILITY Interim Report
Van Nifterick 17 Feb. 1970 7 p
(Contract ESTEC-647-69-AA)
(RV-35; TR-3) Avail: NTIS

The vacuum ultraviolet irradiation test facility at Delft (Holland) after two months' operation is described with emphasis on the ultraviolet source and the sensitive resistor measuring the ultraviolet radiation intensity. ESRO

N71-21056# Kiruna Geophysical Observatory (Sweden).
ON THE RELATION BETWEEN THE AURORAL PARTICLE PRECIPITATION AND THE IONOSPHERIC TROUGH
Ludwik Liszka and Tauno Turunen (Oulu Univ.) Dec. 1970 21 p refs Sponsored in part by Swed. Natl. Council of Nat. Sci. and Finn. Natl. Res. Council of Sci.
(KGO-Preprint-70-315) Avail: NTIS

A comparison between the low energy electron measurements (1 keV) from the ESRO 1A satellite and ionospheric conditions recorded at three Scandinavian ionosondes during the evening and midnight sectors, indicates that the ionospheric trough is located at the southern boundary of the precipitation region. Estimates of the energy input within the low energy part of the spectrum gives typical values of the order of 1 erg/sq cm . sec . ster. It is expected than an energy input of this magnitude will heat the neutral atmosphere within the precipitation region and raise its density. Author (ESRO)

N71-21057# Max-Planck-Institut fur Physik und Astrophysik, Munich (West Germany).
THE FLUX PROFILE OF PROTONS MEASURED IN 1967 AT THE EQUATOR BETWEEN L = 1.15 AND 1.21

E. Achtermann, G. Paschmann, and D. Hovestadt Aug. 1970 29 p refs Sponsored in part by Bundesmin. fuer Bildung und Wiss.
(MPI/PAE-Extraterr-46) Avail: NTIS

The flux versus L profiles of trapped protons measured on board a sounding rocket near the equator in 1967 are compared with calculations based on a neutron albedo source and atmospheric losses. The observed fluxes at three different energy channels (approximately 1 MeV, from 20 to 49 MeV, greater than 100 MeV) exceed the fluxes calculated assuming Lingenfelter's neutron spectrum by factors between 15 and 400. The shapes of the profiles suggest that time variations in the atmospheric density with durations of 15 and 150 days preceding these measurements, affect the fluxes of those protons whose lifetimes are sufficiently short. Author (ESRO)

N71-21095# Meteorologisches Observatorium Hohenpeissenberg (West Germany).
RESULTS OF AEROLOGICAL OZONE SOUNDINGS AND TOTAL OZONE MEASUREMENTS DURING THE FIRST HALF OF 1969 [ERGEBNISSE DER AEROLOGISCHEN OZONSONDIERUNGEN UND DER GESAMTOZONMESSUNGEN IM 1. HALBJAHR 1969]
Oct. 1970 179 p In GERMAN *Its* Sonderbeobachtungen No. 8
Avail: NTIS

The results of ozone soundings above the Hohenpeissenberg Meteorological Observatory (Germany) are given in the form of tables and graphs. ESRO

N71-21096*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROVISIONAL HOURLY VALUES OF EQUATORIAL Dst FOR 1968
Masahish Sugiura and Shirley J. Cain Washington Mar. 1971 20 p refs
(NASA-TN-D-6278; G-1019) Avail: NTIS CSCL 04A

Data from the magnetic observatories at Hermanus, Honolulu, and San Juan are presented in graphs and tables. A separate table of daily mean and monthly mean Dst values is included. D.L.G.

N71-21097# Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.
FOURTH ORDER GRAVITATIONAL POTENTIAL BASED ON THE QUANTUM FIELD THEORY
Yoichi Iwasaki Jan. 1971 12 p refs
(RIFP-114) Avail: NTIS

The fourth-order gravitational potential based on the quantum field theory is calculated in the cases of the scalar field and the dirac field, and the results are discussed in relation to the Dicke-Goldenberg experiment. It is shown that the correspondence principle does not hold in general in the quantum field theory. Author

N71-21151# European Space Research Organization, Paris (France)
ESRO-1/AURORAE SATELLITE: SCIENTIFIC RESULTS FOR SELECTED PERIODS OCTOBER – NOVEMBER, 1968]
R. J. Davidson ed. and R. Jaeschke ed. Nov. 1970 142 p refs Proc. of the ESTEC Seminar, Noordwijk, Neth., 8–9 Jun. 1970
(ESRO-SP-62) Avail: NTIS

CONTENTS:

1. ESRO-1 PHOTOMETER MEASUREMENTS. RELATION OF PROTON TO ELECTRON AURORA AND TO PARTICLE PRECIPITATION: A PRELIMINARY REVIEW A. Omholt (Oslo Univ.), C. S. Deehr (Oslo Univ.), T. A. Sten (Oslo Univ.), G. Gustafsson (Kiruna Geophys. Obs.), A. Egeland (Oslo Univ.) et al p 1–10 refs (See N71-21152 10-13)

2. CORRELATIONS BETWEEN ESRO 1A AURORAL MEASUREMENTS AND GROUND OBSERVATIONS A. Egeland (Oslo Univ.), C. S. Deehr (Oslo Univ.), T. A. Sten (Oslo Univ.), and A. Omholt (Oslo Univ.) p 11–23 refs (See N71-21153 10-13)

3. OBSERVATIONS OF MAGNETIC FIELD-ALIGNED POSITIVE ION FLUXES BY MEANS OF THE S-71B EXPERIMENT ON ESRO-1 AND THEIR INTERPRETATION B. Hultqvist (Kiruna Geophys. Obs.) p 25–26 (See N71-21154 10-13)

4. SOME CHARACTERISTICS OF LOW-ENERGY ELECTRON PRECIPITATION IN THE MIDNIGHT SECTOR DURING QUIET MAGNETOSPHERIC CONDITIONS AND PCA L.-A. Holmgren (Kiruna Geophys. Obs.), G. Gustafsson (Kiruna Geophys. Obs.), and H. Borg (Kiruna Geophys. Obs.) p 27–40 refs (See N71-21155 10-13)

5. OBSERVATION OF SOLAR PROTONS OVER THE SOUTHERN POLAR CAP, DURING THE COSMIC RAY EVENT OF 18 NOVEMBER 1968 K. Aarsnes (Bergen Univ.), R. Amundsen (Bergen Univ.), H. R. Lindalen (Bergen Univ.), and F. Soeraas (Bergen Univ.) p 41–46 refs (See N71-21156 10-13)

6. PRECIPITATION OF PROTONS WITH ENERGIES ABOVE 100 keV, OBSERVED BY THE ESRO 1A SATELLITE IN THE NOON-MIDNIGHT MERIDIAN K. Aarsnes (Bergen Univ.), R. Amundsen (Bergen Univ.), H. R. Lindalen (Bergen Univ.), and F. Soeraas (Bergen Univ.) p 47–58 refs (See N71-21157 10-13)

7. SATELLITE OBSERVATIONS OF ELECTRONS WITH ENERGIES ABOVE 40 keV G. Skovli (Norweg. Defence Res. Estab.) p 59–70 (See N71-21158 10-13)

8. BEHAVIOUR OF THE GEOMAGNETICALLY TRAPPED PARTICLES DURING SOLAR PROTON EVENTS V. Domingo (ESRTC), and D. E. Page (ESRTC) p 71–77 (See N71-21159 10-13)

9. MEASUREMENTS OF 1–30 MeV PROTONS DURING SOLAR PROTON EVENTS G. R. Thomas (Radio and Space Res. Sta.) p 79–84 ref (See N71-21160 10-13)

10. MEASUREMENTS OF 45–450 keV ELECTRONS DURING QUIET AND DISTURBED PERIODS G. R. Thomas (Radio and Space Res. Sta.), and P. A. Smith (Radio and Space Res. Sta.) p 85–110 (See N71-21161 10-13)

11. POLAR IONOSPHERIC PARAMETERS W. J. Raitt (Univ. Coll. London) p 111–120 refs (See N71-21162 10-13)

12. DETECTION OF ELECTRIC FIELDS FROM THE LANGMUIR PROBE EXPERIMENT R. Basto (Univ. Coll. London) p 121–126 (See N71-21163 10-13)

N71-21152# Kiruna Geophysical Observatory (Sweden).
ESRO-1 PHOTOMETER MEASUREMENTS. RELATION OF PROTON TO ELECTRON AURORA AND TO PARTICLE PRECIPITATION: A PRELIMINARY REVIEW
A. Omholt (Oslo Univ.), C. S. Deehr (Oslo Univ.), T. A. Sten (Oslo Univ.), G. Gustafsson, A. Egeland (Oslo Univ.) et al *In* ESRO-1/Aurorae Satellite: Sci. Results for Selected Periods Oct.–Nov., 1968 Nov. 1970 p 1–10 refs Sponsored by Roy. Norweg. Res. Council for Sci. and Technol. (See N71-21151 10-13)
Avail: NTIS

Some preliminary photometer data obtained by the satellites ESRO 1A and B are reviewed. It is shown that the expansion of the auroral ovals with geomagnetic activity is greater for electron aurora than for proton aurora just after geomagnetic midnight. There is good correspondence between the intensities of the N2(+) (4278 A) and the H beta (4861 A) emissions, and the observed precipitation of 6 keV electrons and protons respectively. Attention is drawn to the effect of diffusion of fast hydrogen atoms in the formation of the equatorward zone of high pitch angle protons. Author (ESRO)

N71-21153# Oslo Univ. (Norway). Inst. of Cosmic Physics.
CORRELATIONS BETWEEN ESRO-1A AURORAL MEASUREMENTS AND GROUND OBSERVATIONS

A. Egeland, C. S. Deehr, T. A. Sten, and A. Omholt *In* ESRO-1/Aurorae Satellite: Sci. Results for Selected Periods Oct./Nov., 1968 Nov. 1970 p 11–23 refs (See N71-21151 10-13)
Avail: NTIS

Several examples of ESRO 1A photometer data obtained near geomagnetic midnight are shown. The location and width of the electron and proton oval as functions of both Q and Dst indices are discussed. Author (ESRO)

N71-21154# Kiruna Geophysical Observatory (Sweden).
OBSERVATIONS OF MAGNETIC FIELD-ALIGNED POSITIVE ION FLUXES BY MEANS OF THE S-71B EXPERIMENT ON ESRO-1 AND THEIR INTERPRETATION
Bengt Hultqvist *In* ESRO-1/Aurorae Satellite: Sci. Results for Selected Periods Oct.–Nov., 1968 Nov. 1970 p 25–26 (See N71-21151 10-13)
Avail: NTIS

Investigation of measurements of 1 and 6 keV positive ions made onboard ESRO 1 satellites have revealed that the ion fluxes inside the loss cone are sometimes larger than outside. This anisotropy may be interpreted in terms of magnetic field-aligned electric field near or in the ionosphere. The potential drop caused by the average equivalent temperature for the plasma sheaths is discussed. ESRO

N71-21155# Kiruna Geophysical Observatory (Sweden).
SOME CHARACTERISTICS OF LOW-ENERGY ELECTRON PRECIPITATION IN THE MIDNIGHT SECTOR DURING QUIET MAGNETOSPHERIC CONDITIONS AND PCA
Lars-Ake Holmgren, Georg Gustafsson, and Hans Borg *In* ESRO-1/Aurorae Satellite: Sci. Results for Selected Periods Oct.–Nov., 1968 Nov. 1970 p 27–40 refs Sponsored partly by Swed. Nat. Sci. Res. Council, Swed. Board for Tech. Develop., and ESRO (See N71-21151 10-13)
Avail: NTIS

Low-energy electron data obtained by the experiment S-71B of Kiruna Geophysical Observatory onboard the ESRO 1A (Aurorae) satellite during a period of fairly quiet magnetosphere and a period with a PCA event is described. Latitudinal extent and position of the precipitation of low-energy electrons, as well as spectral characteristics, are discussed and exemplified for various degrees of magnetic disturbances. The influence of PCA on the low-energy electron population is also considered. Author (ESRO)

N71-21156# Bergen Univ. (Norway). Dept. of Physics.
OBSERVATION OF SOLAR PROTONS OVER THE SOUTHERN POLAR CAP, DURING THE COSMIC RAY EVENT OF 18 NOVEMBER 1968
K. Aarsnes, R. Amundsen, H. R. Lindalen, and F. Soeraas *In* ESRO-1/Aurorae Satellite: Sci. Results for Selected Periods Oct.–Nov., 1968 Nov. 1970 p 41–46 refs Sponsored by Roy. Norweg. Res. Council for Sci. and Technol. (See N71-21151 10-13)
Avail: NTIS

Preliminary results from the solar proton event of 18 November 1968 are given. The data discussed has been gained by detectors working in six different energy levels onboard ESRO 1A satellite. Energy spectra for three consecutive days are presented but it is difficult to ascertain the exact onset time of the event because of the time resolution of the satellite. ESRO

N71-21157# Bergen Univ. (Norway). Dept. of Physics.
PRECIPITATION OF PROTONS WITH ENERGIES ABOVE 100 keV, OBSERVED BY THE ESRO-1A SATELLITE IN THE NOON-MIDNIGHT MERIDIAN
K. Aarsnes, R. Amundsen, H. R. Lindalen, and F. Soeraas *In* ESRO-1/Aurorae Satellite: Sci. Results for Selected Periods Oct.–Nov., 1968 Nov. 1970 p 47–58 refs Sponsored by the Roy. Norweg. Res. Council for Sci. and Technol. (See N71-21151 10-13)
Avail: NTIS

Some data on precipitating protons with energies above 100 keV observed by the ESRO 1A satellite are presented. The observed count rates of trapped and precipitated protons, measured under different geomagnetic conditions, are plotted against invariant latitude. Contours of constant intensities of precipitating protons are given as a function of invariant latitude and universal time for both dayside and nightside. ESRO

N71-21158# Norwegian Defence Research Establishment, Kjeller.
SATELLITE OBSERVATIONS OF ELECTRONS WITH ENERGIES ABOVE 40 keV
Gunnar Skovli *In* ESRO-1/Aurorae Satellite: Sci. Results for Selected Periods Oct.–Nov., 1968 Nov. 1970 p 59–70 (See N71-21151 10-13)
Avail: NTIS

A brief description is given of the S-71D experiment onboard the ESRO 1A satellite. The experiment was primarily directed to the study of fast variations and fine structures in the intensities and angular distributions of the energetic electrons above 40 keV. Some examples of the measurements made are presented, together with a preliminary analysis of the data. Author (ESRO)

N71-21159# European Space Research and Technology Center, Noordwijk (Netherlands).
BEHAVIOUR OF THE GEOMAGNETICALLY TRAPPED PARTICLES DURING SOLAR PROTON EVENTS
V. Domingo and D. E. Page *In* ESRO-1/Aurorae Satellite: Sci. Results for Selected Periods Oct.–Nov., 1968 Nov. 1970 p 71–77 (See N71-21151 10-13)
Avail: NTIS

Information from Geiger-Muller counters onboard ESRO 1A satellite is being used to study the effects of solar proton flares on trapped particles over the polar cap region. Counting rates during periods of quiet magnetic activity and during a period when a high level of solar energetic particles has been detected outside the magnetosphere are presented and discussed. ESRO

N71-21160# Radio and Space Research Station, Slough (England).
MEASUREMENTS OF 1-30 MeV PROTONS DURING SOLAR PROTON EVENTS
G. R. Thomas *In* ESRO-1/Aurorae Satellite: Sci. Results for Selected Periods Oct.–Nov., 1968 Nov. 1970 p 79–84 refs (See N71-21151 10-13)
Avail: NTIS

Solar proton measurements made onboard the ESRO 1A (Aurorae) satellite in the energy range from 1 to 30 MeV for the periods 31 October–3 November 1968 and 15–21 November 1968 are presented. ESRO

N71-21161# Radio and Space Research Station, Slough (England).
MEASUREMENTS OF 45–450 keV ELECTRONS DURING QUIET AND DISTURBED PERIODS
G. R. Thomas and P. A. Smith *In* ESRO-1/Aurorae Satellite: Sci. Results for Selected Periods Oct.–Nov., 1968 Nov. 1970 p 85–110 (See N71-21151 10-13)
Avail: NTIS

Some preliminary results of an analysis of energy spectra of trapped and precipitated electrons onboard the ESRO-1 satellite are presented, mainly for the magnetically disturbed period 29 October–4 November 1968, but some of the results refer to the quiet period 23–27 October 1968. ESRO

N71-21162# University Coll., London (England). Mullard Space Science Lab.
POLAR IONOSPHERIC PARAMETERS
W. J. Raitt *In* ESRO-1/Aurorae Satellite: Sci. Results for Selected Periods Oct.–Nov., 1968 Nov. 1970 p 111–120 refs (See N71-21151 10-13)
Avail: NTIS

Results of one of the two ionospheric experiments onboard the ESRO-1 satellite are presented. The sensor considered was a planar collector with its normal parallel to the geomagnetic field. Profiles of electron temperature and electron density for quiet conditions and disturbed conditions are shown. ESRO

N71-21163# University Coll., London (England). Mullard Space Science Lab.
DETECTION OF ELECTRIC FIELDS FROM THE LANGMUIR PROBE EXPERIMENT
R. Basto *In* ESRO-1/Aurorae Satellite: Sci. Results for Selected Periods Oct.–Nov., 1968 Nov. 1970 p 121-126 (See N71-21151 10-13)
Avail: NTIS

The ESRO-1 satellite carried two Langmuir probes to measure the electron temperature and the electron density in the ionosphere. By determining the bias voltage for the two probes on the satellite, which were 2.4 m apart, it was hoped that the difference would give the magnitude of any electric field present in the atmosphere. Results obtained are discussed and it was concluded that more accurate methods of processing the data should be used. ESRO

N71-21164# National Research Council of Canada, Ottawa (Ontario).
TWILIGHT HELIUM EMISSIONS IN HIGH LATITUDES [SUMERECHNAYA EMISSIYAGELIYA V. VYSOKIKH SHIROTAKH]
N. I. Fedorova 1970 16 p refs Transl. into ENGLISH from Sb. Statei: Ser. Rezultaty MGG (USSR), no. 13, 1966 p 53–63
(NRC-TT-1441) Avail: NTIS

Regular observations of the helium emission lambda 10830 A at station Loparskaya U.S.S.R. during the winter periods in 1960 to 1963 show that the helium emission was observed only in twilight spectra with the intensity from 200 Rayleighs lower to 3000 Rayleighs. Strong helium emission with the intensity of more 2000 Rayleighs, as a rule, is observed during high magnetic and solar activity, but there is no direct correlation between them. With the decrease of solar activity from 1960 to 1963 the intensity lambda 10830 A did not change noticably. During the red aurora of the A-type a very intensive helium emission was always observed; while no correlation was detected with the low forms of aurora. Author

N71-21165# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
SULFATES AND OTHER WATER SOLUBLES LARGER THAN 0.15 MICRONS RADIUS IN A CONTINENTAL NONURBAN ATMOSPHERE
Gayle S. Rinehart Oct. 1970 36 p refs
(AD-716999; ECOM-5336) Avail: NTIS CSCL 4/1

Number concentrations of large and giant atmospheric particles and particles containing sulfate and water-soluble constituents were determined. Particles were collected by means of an Andersen multistage impactor and examined by means of an optical microscope. The number of particles collected and concentration of sulfate and water-soluble particles at the isolated New Mexico sampling site were comparable to literature-cited values of average continental concentrations over mountains or unpolluted areas. The number concentrations of giant and large particles did not appear to be influenced in the same way by meteorological parameters. Increases in the number of large particles were mirrored by corresponding increases in sulfate content. Data for relating Andersen sampler aerosol number concentrations to concentrations reflected by the Royco 202 light scattering aerosol counter are given. Author (GRA)

N71-21187# Lamont Geological Observatory, Palisades, N.Y.
GEOCHEMICAL STUDIES OF CONTINENTAL WATERS Annual Report
Wallace S. Broecker and David L. Thurber Oct. 1970 282 p refs
(Contract AT(30-1)-2493)
(CU-2493-11) Avail: NTIS

Natural lakes were studied to obtain information on the fate of artificially produced radionuclides added to the waters. The transfer of tritium from the atmosphere to Crater Lake, Oregon, is considered to be mainly by precipitation, with vapor exchange adding some. Ionic species were studied in dilute lakes, Crater Lake and Lake Tahoe, and in saline lakes, principally Mono Lake, California. The potential of natural radon as an indicator of groundwater input and gas exchange was studied in shallow Cranberry Lake, New York. Urban waters in the Greater New York area were analyzed to determine the cycling and transport of pollutants. The distribution of Rn-222 in groundwater, streams, and lakes in western Ontarior was measured, and the Rn-222/Rn-226 ratio was measured in a lake spiked with Ra-226 to determine gas exchange rates. N.E.N.

N71-21194# Atmospheric Sciences Office White Sands Missile Range, N.Mex.
TECHNICAL DATA PACKAGE FOR ROCKET BORNE OZONE TEMPERATURE SENSOR
J. S. Randhawa Oct. 1970 106 p refs
(AD-716997; ECOM-5338) Avail: NTIS CSCL 4/1

The design and performance requirements are described for a transistorized 1680 MHz rocket-borne temperature-ozonesonde capable of measuring ozone concentration and temperature on time-sharing basis from 65 km to 10 km. Engineering sketches for the instrument and power supply are included as part of this package. Author (GRA)

N71-21204# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
SHORT TIME PERIOD ATMOSPHERIC DENSITY VARIATIONS AND A DETERMINATION OF DENSITY ERRORS FROM SELECTED ROCKETSONDE SENSORS
B. T. Miers, R. O. Olsen, and E. P. Avara Oct. 1970 40 p refs
(AD-716995; ECOM-5335) Avail: NTIS CSCL 4/1

Atmospheric density changes as observed from nine soundings taken over a three and one half hour time span are described. Arcasonde, Datasonde and inflatable falling sphere sensors were used to determine the density structure. There was general agreement between the mean densities derived from the spheres and the Arcasonde and Datasonde sensors; however, the sphere data show more variation from sounding to sounding. A paired data test using 42 soundings showed that the first estimate of the standard deviation of sensor random error of density for the Arcasonde was 0.75%, for the Datasonde 0.77%, for the sphere 2.86% and for the Arcasonde-Datasonde comparisons 1.38%. In an analysis of variance procedure, the percentage change in atmospheric density over various time spans was determined. Author (GRA)

N71-21214*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
COMPETITIVE REACTION OF O(3P) WITH OZONE AND CARBONYL SULFIDE
D. C. Krezenski 15 Feb. 1971 59 p ref
(Grant NGL-39-009-003)
(NASA-CR-117486; SR-368) Avail: NTIS CSCL 04A

The competitive reaction of O(3P) atoms with O3 and OCS was investigated in the temperature range 197 K - 299 K. The relative rate constants for the reactions O(3P) + O3 yields 2O2 and O(3P) + OCS yields CO + SO were determined and found to be independent of irradiation time, absorbed intensity, and the addition of a foreign gas. The absolute value of k sub 1 = 1.1 x 10 to the minus 11th power exp(-4330/RT) cu cm/particle-sec, was calculated from a pre-determined value of k sub 3. The value of k sub 3 was determined from a similar competitive study of O3P) atoms with 2-trifluoromethylpropene (TMP) and OCS in the temperature range 300 K - 523 K. The value of k sub 3 = 1.63 x 10 to the minus 11th power exp(-4500/RT) cu cm/particle-sec, was calculated from the known rate constant of the O(3P) reaction with TMP. The value of k sub 1 determined is in excellent agreement with the value k sub 1 determined from the collective previous works in the temperature range of 300 K - 1150 K.
Author

N71-21256# California Univ., Livermore. Lawrence Radiation Lab.

SHOCK WAVES. 2: TRANSPORT AND OTHER PROPERTIES

R. N. Keeler 5 Nov. 1970 12 p refs Presented at Proc. of the Intern. School of Phys., Varenna, Italy, 13–25 Jul. 1970 Submitted for publication Sponsored by AEC
(UCRL-72770) Avail: NTIS

The use of shock waves for providing seismological data concerning the minerals, metals, and alloys which make up the interior of the Earth is discussed. Subjects presented are: (1) transport and other properties of shock waves, (2) electrical conductivity of alloys with changes in pressure, and (3) X-ray diffraction in shock compressed solids.
NSA

N71-21270# TUAB Teleutredningar A.B., Solna (Sweden). Space Technology Group.

THE K68 CAMPAIGN AT ESRANGE IN OCTOBER 1968 AND THE A69 CAMPAIGN AT ANDOYA IN JANUARY 1969 Final Report

S. Lundin 30 Oct. 1970 12 p refs
(Rept-S3-K68-44) Avail: NTIS

An account is given of the cooperative sounding rocket campaign conducted by SSRC and NASA which was to investigate the electron and ion density in the D and E regions during aurora. The experiments, organisation, and results are described and a summary of the firings given.
ESRO

N71-21277# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

TROPOSPHERIC EFFECT ON ELECTROMAGNETICALLY MEASURED RANGE: PREDICTION FROM SURFACE WEATHER DATA

Helen S. Hopfield Jul. 1970 42 p refs
(Contract NOw-62-0604-C)
(AD-716774; APL-TG-1119) Avail: NTIS CSCL 4/1

The height integral of tropospheric refractivity (n-1), where n is refractive index, measures the range error in a vertically arriving electromagnetic signal. Such height integrals were studied, using meteorological balloon data from widely separated locations. Although the dry part of (n-1) at any point in the troposphere depends on both pressure and temperature (P/T), its height integral was found to be a linear function of surface pressure only, both theoretically and from observed data. The equivalent height for the quartic model of (n-1)dry must therefore vary as surface temperature. Height parameters were computed from balloon data and were closely the same for all stations; a dry height of 40.1 km at 0C, decreasing to zero near 0K. Using these, the model predicts vertical range error (dry part) within a few millimeters rms. Study of the very much smaller but more variable wet contribution is continuing.
Author (GRA)

N71-21284# National Research Council of Canada, Ottawa (Ontario).

STRATOSPHERIC TURBULENCE AND TEMPERATURE GRADIENTS MEASURED BY AN RB-57F. COLDSCAN FLIGHTS 19 TO 56

J. I. Mac Pherson (Natl. Aeron. Estab.) and E. G. Morrissey (Natl. Aeron. Estab.) Nov. 1970 80 p refs
(LR-542) Avail: NTIS

Since January 1969, a weather reconnaissance aircraft has carried a special instrumentation system to measure and record stratospheric turbulence and horizontal temperature gradients encountered at altitudes from 40,000 to above 60,000 feet, altitudes to be flown by the supersonic transports. To date 57 data flights have been flown, covering 82,000 nautical miles of the central and western United States, Ontario and the Pacific Ocean south of Panama. Detailed accounts of a selection of 20 events from Flights 19 through 56 show significant temperature gradients or light to moderate turbulence. These presentations include time histories of the recorded variables, flight tracks showing event positions, and meteorological analyses. Data are presented on the correlation between measured stratospheric turbulence and horizontal temperature gradients, on the altitude and geographical distribution of the turbulence and temperature change encounters, and on the positions of the recorded incidents relative to the jet stream.
Author

N71-21296*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

OBSERVATIONS OF THE INLAND DELTA OF THE NIGER RIVER BY NIMBUS 3 HIGH-RESOLUTION INFRARED RADIOMETER (HRIR)

N. H. Mac Leod Aug. 1970 14 p
(NASA-TM-X-65469; X-652-70-315) Avail: NTIS CSCL 08E

The HRIR imaging of earth-surface features in daytime depends upon differences in reflectance of water, sand, vegetation, clouds, and other surfaces. The series of HRIR images showing the inland delta of the Niger River demonstrates the use of such data in natural resource studies. The information gleaned from the imagery on seasonal plant and surface-water changes in the inland delta is based on two features of HRIR that are unique in space photography: the distinct contrasts between surface water and most other surface features, and the repetitive (daily) large-scale coverage of the area, which generates a time-lapse series of images of changing phenomena.
Author

N71-21297*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

GODDARD RANGE AND RANGE RATE AND LASER STATION COORDINATES FROM GEOS-2 DATA

J. G. Marsh, B. C. Douglas (Wolf Res. and Develop. Corp.) and S. M. Klosko (Wolf Res. and Develop. Corp.) Jan. 1971 27 p refs
(NASA-TM-X-65475; X-552-71-52) Avail: NTIS CSCL 14B

Dynamic solutions combining optical, laser, and Goddard Range and Range Rate (GRARR) observations of GEOS-2 yielded definitive results for center of mass station coordinates for three laser and four GRARR tracking sites. Comparisons with independent solutions and internal consistency suggest an accuracy of 10 meters or better in most cases. Comparisons of intersite distances on a datum suggest accuracy equal to or better than that usually associated with first order surveys. The outstanding consistency obtained with combinations of optical and scale-providing data suggest that the value of GM (= 3.986013 × 10 to the 14th power cu m/sec sq) obtained from deep space tracking is highly accurate.
Author

N71-21298*# Stanford Univ., Calif. School of Engineering.

AIR IMPROVEMENT RECOMMENDATIONS FOR THE SAN FRANCISCO BAY AREA Final Report on the Stanford Ames NASA/ASEE Summer Faculty Systems Design Workshop

George D. Sauter and Ernest G. Chilton, eds. Oct. 1970 276 p refs Sponsored by part by the Am. Soc. of Engr. Educ.
(Grant NGR-05-020-409)
(NASA-CR-114292) Avail: NTIS CSCL 04A

The air pollution problem in the Bay Area, the pollutants, and possible air monitoring and pollutant source surveillance system are studied and specific recommendations for an effective control program are presented. The roles of Federal, State, and local control agencies are discussed, and the control programs currently in effect are described. Improved monitoring systems for air quality and source emissions, the type of data to be acquired, data handling and storing methods, and the predictive capability of models using these data are described. Short-term and long-term recommendations to control programs are made. The former include increased public awareness and support of control agencies, more efficient regulation enforcement, and internal administrative changes. The long-term recommendations include suggestions for alternate means for providing goods and services whose present production yields excessive pollution, reduction in demand for such goods and services, and the inclusion of pollution considerations in regional planning and development. N.E.N.

N71-21304*# Coast Guard, Washington, D.C. Applied Technology Div.
RESULTS OF OVERFLIGHTS OF CHEVRON OIL SPILL IN GULF OF MEXICO Final Report
Clarence E. Catoe 24 Aug. 1970 20 p refs Sponsored by NASA Original Contains Color Illustrations
(NASA-CR-117497; AD-714681) Avail: NTIS CSCL 14/5

The NASA 927, Earth Resources Aircraft, at Coast Guard request, flew over the Chevron Oil Spill on 16 March 1970, during the day and night. The aircraft was equipped with photographic, infrared, and radar type systems, which collected the data in the oil spill area. Ground truth data during these overflights was collected by Coast Guard personnel and a team of oceanographers from Louisiana State University. The initial data received from NASA, Manned Spacecraft Center was restricted to photographic and 8 to 14 micrometer scanner data. The preliminary analysis of the test results obtained is limited to the above mentioned applicable sensors. Author (GRA)

N71-21313 Colorado Univ., Boulder.
THE IONOSPHERIC WIND DYNAMO
Jerald Dan Tarpley, Jr. (Ph.D. Thesis) 1969 183 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 70-5897)

The partial differential equation that describes the response of the ionosphere to a wind-induced emf is derived and the appropriate boundary conditions are discussed. The solutions of the dynamo equation under certain special conditions are described and a numerical method is presented by which the dynamo equation can be solved in the general case. A detailed conductivity model is calculated for the 90 to 150 km region of the ionosphere. The conductivity model contains the local time, latitude, and height variations of the ionospheric conductivity. The relevant parts of tidal theory are discussed and some direct observations of E-region winds are review with the goal of constructing such models. The electric currents generated by the solar diurnal (1,3), (1,−1), and (1,−3) modes, the solar semidiurnal (2,2) and (2,4) modes, and certain nonperiodic winds are also calculated. The currents generated by the solar (1,-1) mode are found to be quite similar to observationally deduced Sq current systems. Dissert. Abstr.

N71-21380 National Lending Library for Science and Technology, Boston Spa (England).
MINERAL CONTENT OF SEDIMENTS [MINERALNIY SOSTAV OSADKOV]
M. V. Klenova Aug. 1970 46 p refs Transl. into ENGLISH from the publ. 'Geologiya Barentsova Morya' Moscow, 1960 p 228−268
(NLL-RTS-5641) Avail: Natl. Lending Library, Boston Spa, Engl.; 92s; 15 NLL photocopy coupons

The petrographic content of Barents Sea sediments is discussed with respect to material distribution. Sedimentation and migration of detrital material are the prominent features. Only in certain isolated areas, mostly on shallows and in litoral areas, are any significant accumulations of biogenic remains found. These are often carbonates, but siliceous sponge spicules in the west. Rotaliidae occur frequently and predominantly in the southern and central parts, where there is reduced salinity. Urchin spine fragments are found in the southwest corresponding to known areas of habitation. N.E.N.

N71-21411# Advisory Group for Aerospace Research and Development, Paris (France).
THE STRUCTURE AND DYNAMICS OF THE TROPOSPHERE
P. Raethjen *In its* Tropospheric Radio Wave Propagation, Pt. 1 Feb. 1971 12 p (See N71-21409 10-07)
Avail: NTIS

A three-fluids general atmospheric circulation model is described that uses a large rotating water bowl to realize Prandl's theoretical atmospheric flow model. Experimental results obtained with the water basin containing three liquids of differing densities indicate that a weak meridian flow polewards is the cause of strong western winds. Atmospheric cyclones at higher latitudes originate where an upper branch of meridian circulation, far advanced in a direction towards the pole, commences its descent. G.G.

N71-21412# Environmental Science Services Administration, Boulder, Colo.
WORLDWIDE CHARACTERISTICS OF REFRACTIVE INDEX AND CLIMATOLOGICAL EFFECTS
B. R. Bean, B. A. Hart, and G. D. Thayer *In* AGARD Tropospheric Radio Wave Propagation, Pt. 1 Feb. 1971 14 p refs (See N71-21409 10-07)
Avail: NTIS

The development and present status of radio climatology are reviewed, from Newton's use of the exponential atmosphere to recent work on the climatology of radio refractive index turbulence. (1) development of models of the general vertical structure of the refractive index with a three-part exponential profile; (2) the general refractive index gradient, elevated layers with strong refractive index gradients, and winds in the common volume region which are significant to the performance of transhorizon radio propagation systems; (3) studies of the climatology of the initial gradient of the radio refractive index which have revealed that the tropical areas of the world experience the most severe conditions; and (4) the likelihood of turbulence of the radio refractive index as determined from the gradient of the potential refractive index and calculated from conventional meteorological soundings of the atmosphere. Author

N71-21482# Lockheed Missiles and Space Co., Palo Alto, Calif.
ION COMPOSITION OF THE ATMOSPHERE AT 100-200 km ALTITUDES AND ITS GOVERNING PROCESSES
A. D. Danilov [1970] 10 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 10, no. 5, 1970 p 815−822
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Mass spectrometer investigations of the ion composition of the Earth's atmosphere at 100 to 200 kilometers altitude and its governing processes are described. A comparison of results of measuring the ion composition shows that a definite behavior of the absolute ion concentrations is dependent on the zenith angle of the sun. It is shown that the photochemical theory describes the observed altitude and diurnal behavior of the concentrations. At altitudes below 130 kilometers, the molecular reaction between $O2(+)$ and N should play an important part. Author

N71-21503# Oregon State Univ., Corvallis. Range Management Program.

AN ANALYSIS OF STATE OWNED RANGELAND RESOURCES FOR MULTIPLE USE MANAGEMENT IN SOUTHEASTERN OREGON

Charles E. Poulton and Arleigh G. Isley Aug. 1970 132 p refs

Avail: Issuing Activity

Selected information and statistical summaries essential to convey a picture of the kind and potential of the rangeland held by the State and needed for administrative levels for policy formulation and broad program guidance are presented. The opportunities in resource development and management of the lands are described, and the size of the land management and rehabilitation program that may be involved is indicated. Summarized data are given by county and by ecological province. Physical and vegetational resources, improvement and development potential, existing physical facilities, retain-dispose management level suggestions, and specific recommendations are discussed. N.E.N.

N71-21541*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MULTIPLE EARTH'S BOW SHOCK CROSSING AT LARGE GEOCENTRIC DISTANCES

B. Bavassano (Rome Univ.), F. Mariani (Rome Univ.), U. Villante (Rome Univ.), and N. F. Ness Feb. 1971 23 p refs Submitted for publication

(NASA-TM-X-65474; X-690-71-42) Avail: NTIS CSCL 03C

A series of very distant earth's bow shock crossings was identified by the magnetic field experiment on board Pioneer 8 at geocentric distances between 120 and 200 R sub E (1R sub E = earth's radius), during the period December 19 to 25, 1967. The normal to the shock was generally found lying in or very near the ecliptic plane, at an average angle of 70 deg with respect to the earth-sun line. The average ratio of field magnitudes on the interplanetary and the magnetosheath sides of the bow shock was very near to 2. The location of the crossings was consistent with that expected from computations of the distant bow shock configuration, when the aberration of the solar wind was taken into account. The shock was also aligned with the configuration extrapolated from the Explorer 33 observations which extend only to 75 R sub E. It is concluded that a well developed bow shock is still observed at very large distances. The intermittent observations are interpreted as an effect of the sweeping back and forth of the shock across the spacecraft orbit, due to time variations of the solar wind. Author

N71-21542# Office of Naval Research, London (England).

ELECTRONIC ENGINEERING IN OCEAN TECHNOLOGY

Richard O. Rowlands 2 Dec. 1970 15 p Conf. held at Swansea, Wales, 21–24 Sep. 1970

(AD-716949; ONRL-C-30-70) Avail: NTIS CSCL 8/10

The conference was hardware oriented. The equipment described consisted of oceanographic sensors, sonar systems, shipboard computers, communication and navigation systems. Author (GRA)

N71-21552# Tokyo Univ. (Japan). Inst. for Nuclear Study.

MUONS IN ATMOSPHERIC STORMS WITH ENERGY LEVELS GREATER THAN 100000 TeV [MUONES EN CHUBASCOS ATMOSFERICOS CON ENERGIAS MAYORES A 100000 TeV]

K. Suga, S. Shibata, S. Mikamo, Y. Toyoda (Kobe Univ.), K. Murakami et al (Inst. of Phys. and Chem. Res., Tokyo, Japan) *In* Univ. Mayor de San Andres Sum. of Res. Proj. for 1969, No. 33 Feb. 1970 p 173–186 refs Prepared in cooperation with Kobe Univ., Inst. of Phys. and Chem. Res., Tokyo, Md. Univ., and Univ. Mayor de San Andres (See N71-21545 10-29)

Avail: NTIS

High energy muons in air showers of cosmic radiation which were observed at Chacaltaya, Bolivia by using a 60 sq m detector are discussed. It is deduced, from the distribution of the muon count, that the primary particles of cosmic radiation with energies greater than 10 to the 17th power eV are principally protons. Other particles, with energies greater than 10 to the 7th power eV produced by reaction of the high energy muons with the detectors were also registered. Transl. by F.O.S.

N71-21553# Michigan Univ., Ann Arbor.

RADIO STORMS ON MONTE CHACALTAYA [RADIO CHUBASCOS EN EL MONTE CHACALTAYA]

W. E. Hazen, A. Z. Hendel, Howard Smith, and N. J. Shah *In* Univ. Mayor de San Andres Sum. of Res. Proj. for 1969, No. 33 Feb. 1970 p 187–204 refs In SPANISH (See N71-21545 10-29)

(Grant AF-AFOSR-1460-68A) Avail: NTIS

To determine the size of ionospheric storms, radio pulses produced by cosmic ray showers were studied by inclining log periodic antennas to the North, and then to the East. In both cases the storm was indicated as coming from the direction the antenna was pointing. It is concluded that the strength of the pulse does not indicate the extent of the storm. Transl. by F.O.S.

N71-21554# Maryland Univ., College Park. Dept. of Physics and Astronomy.

HADRON SPECTRUM IN THE ATMOSPHERE [ESPECTRO DE HADRONES EN LA ATMOSFERA]

R. Ellsworth and G. B. Yodh *In* Univ. Mayor de San Andres Sum. of Res. Proj. for 1969, No. 33 Feb. 1970 p 205–217 In SPANISH Presented at the 11th Intern. Conf. on Cosmic Radiation, Budapest, 24 Aug.–5 Sep. 1969

(Contract F44620-69-C-0019)

Avail: NTIS

The published data on cosmic hadron flux were studied for various altitudes with emphasis on the intensity and flux composition as a function of energy for particles between 50 and 10,000 GeV. Results are summarized for the hadron spectra of pressures greater than 450 gr/sq cm. Transl. by F.O.S.

N71-21625# Mississippi State Univ., State College. Water Resources Research Inst.

PROCEEDINGS OF 5th MISSISSIPPI WATER RESOURCES CONFERENCE

1970 199 p refs Conf. held at Jackson, Miss., 14–15 Apr. 1970 Sponsored by Dept. of Interior

(PB-196731; W71-03380) Avail: NTIS CSCL 08H

The topics discussed include seaport and transportation development, hurricane damage mapping, hurricane frequency, flood insurance, flood control, alluvial channel morphology, scour, water importation for irrigating the Texas High Plains, recreation, mapping, tracer studies, water analysis, and water pollution indicator organisms. Author (GRA)

N71-21664# Joint Publications Research Service, Washington, D.C.

GEOMORPHOLOGICAL AND GEOLOGICAL INTERPRETATION OF SPACE PHOTOGRAPHS OF THE EARTH (TULAROSA BASIN, USA)

Al. A. Grigoryev 12 Mar. 1971 10 p refs Transl. into ENGLISH from Izv. Vses. Geogr. Obshchestva (Moscow), v. 102, no. 5, Sep.–Oct. 1970 p 435–445

(JPRS-52606) Avail: NTIS

Geological details of the Tularosa Basin, New Mexico, are described for Aerobee photographs taken at altitudes of 112 to 122 km. Rock composition, moisture content of soils, vegetation, boundaries of ridges and plateaus, mountains ranges, and faults are

discussed. Potentialities for the utilization of spaceborne photographs of earth are listed. N.E.N.

N71-21670# Ionospharen-Institut Breisach (West Germany).
IONOSPHERE DATA, VERTICAL-ECHO-SOUNDING: FREIBURG, URSI-CODE 131, NOVEMBER 1970 [IONOSPHAEREN-DATEN, VERTIKAL-ECHO-LOTUNG: FREIBURG, URSI-CODE 131, NOVEMBER 1970]
Nov. 1970 43 p refs In GERMAN and ENGLISH
(Rept-293-F) Avail: NTIS

Daily summaries are presented for vertical echo sounding of the ionosphere over Freiburg, Germany during November 1970. The data include charts of median values for the E and F regions, MUF(3000)F2, M(3000)F2, h'F2, hpF2, foF1, MUF(3000)F1, h'F, foE, FoE2, h'E, foEs, fbEs, h'Es, Type Es, foT, and fmin. Author

N71-21671# Israel Program for Scientific Translations, Ltd., Jerusalem.
AIRBORNE ELECTROPROSPECTING WITH ROTATING MAGNETIC FIELDS
Yu. B. Shaub 1970 189 p refs Transl. into ENGLISH of the book 'Osnovy Aeroelektrorazvedki Metodom Vrashchayushchegosya Magnitnogo Polya' Leningrad, Geostoptekhizdat., 1963 Sponsored by ESSA and NSF
(TT-70-50059) Copyright Avail: NTIS

Airborne electroprospecting using rotating magnetic fields is systematically presented. Calculations are given regarding the anomalous effects of a conductive medium and bodies of regular form, field and laboratory measuring equipment and methods are described, and results of field work are summarized. In addition many general topics connected with modern airborne methods are discussed, such as the efficiency of the various versions of airborne prospecting, noise immunity of the applicable measurement systems, distortion of the anomalies by the inertia of measuring instruments, detection of the useful signals against strong noise background, application of correlation analysis to processing the data. Author

N71-21686# Joint Publications Research Service, Washington, D.C.
EFFECTS OF NATURAL AEROSOLS ON ATMOSPHERIC CONTENT OF CHARGED PARTICLES AND POSSIBLE EXPERIMENTS WITH ARTIFICIAL INJECTION OF AEROSOLS INTO THE D-REGION
Yu. A. Bragin et al 9 Mar. 1971 7 p refs Transl. into ENGLISH from Geomagn. Aeron. (Moscow), v. 10, no. 6, 1970 p 1092–1094
(JPRS-52562) Avail: NTIS

The equilibrium equations for small ions in the regions of nacreous and noctilucent clouds are derived and applied to the problems involved in reducing the atmospheric concentration of charged particles when aerosol particles are sprayed into them. Analysis of observations of the effects during ionospheric explosions reveal that the explosion of 5kg of HEX was adequate for reducing n sub e at 140 km altitude. The decrease is considered a probable result of electron recombination on the products of the explosion. F.O.S.

N71-21728# General Research Corp., Santa Barbara, Calif.
ANALYSIS OF LOS ANGELES ATMOSPHERIC REACTION DATA FROM 1968 TO 1969 Final Report
A. Q. Eschenroeder and J. R. Martenez Jul. 1970 95 p refs Sponsored by Coordinating Res. Council, Inc.
(PB-196825; GRC-CR-1-170) Avail: NTIS CSCL 13B

Analysis of air pollution data from the Los Angeles basin program identifies some of the significant photochemical aspects of the control problem. Data processing of the detailed gas chromatograph measurements provides distributions of hydrocarbons among reactivity classes. Mole-weighted averages place the hydrocarbon mixture between ethylene and 1-alkenes on a biological-effects response scale. Upper bound curves for peak hourly oxidant show that somewhat more stringent control would be needed for oxides of nitrogen than for nonmethane hydrocarbon to achieve a given oxidant standard. Tests employing the 1969 data indicate a breakdown of the quasi-equilibrium assumption for the NO/NO2/O3 cycle as ozone concentration departs from zero. The helicopter and tetroon results are likely to prove useful as validation benchmarks for mathematical modeling studies. Author (GRA)

N71-21729# California Inst. of Tech., Pasadena. Earthquake Engineering Research Lab.
STRONG-MOTION EARTHQUAKE ACCELEROGRAMS: DIGITIZED AND PLOTTED DATA. VOLUME 1: UNCORRECTED ACCELEROGRAMS, PART B: ACCELEROGRAMS IB21 THROUGH IB40
Oct. 1970 202 p
(Grant NSF GK-1197)
(PB-196823; EERL-70-21-Vol-1-Pt-B) Avail: NTIS CSCL 08K

The report is one of a series containing digitized, analyzed and plotted data from strong motion earthquake accelerograms. Volume I includes the uncorrected digitized accelerograms with printouts and plotted records. Part B contains the data from the twenty records labeled IB21 to IB40. Author (GRA)

N71-21736# Gulf Energy and Environmental Systems, Inc., San Diego, Calif.
ATMOSPHERIC TRANSPORT OF X-RAYS Final Report
R. J. Harris, Jr., M. J. Nowak, J. A. Lonergan, J. P. Wondra, D. F. Willoughby et al 16 Jun. 1970 159 p refs
(Contract DASA01-69-C-0038)
(AD-716801; GA-10165; DASA-2571) Avail: NTIS CSCL 4/1

Due to the lack of measured data for checking calculational results, an experimental program was initiated at Gulf General Atomic (GGA) for studying the atmospheric transport properties of X-rays by using liquid nitrogen to simulate air. Measurements of the photon spectrum and angular distribution were made as a function of source-detector separation distance in an infinite medium of liquid nitrogen provided by a large cryogenic dewar. Radioactive isotopes of 241Am, 141Ce, and 203Hg were used as sources of approximately monoenergetic photons with energies of 60 keV, 145 keV and 279 keV, respectively. A 20 cc cm Ge(Li) detector was used to measure photon spectra for energies from approximately 20 keV to the source energy. Measurements were made for source detector distances of 1-15 mfp for each source energy. Transport calculations were made for comparison with the measurements using the PHOTRAN Monte Carlo code and the 1DF discrete ordinates code. Author (GRA)

N71-21781# Environmental Research Corp., Las Vegas, Nev.
SEISMIC RESPONSE CHARACTERISTICS AT SNRDS FROM UNDERGROUND NUCLEAR DETONATIONS
B. G. Weetman, L. L. Davis, W. N. Hays, and R. A. Mueller Dec. 1970 99 p refs
(Contract AT(29-2)-1163)
(NVO-1163-TM-22) Avail: NTIS

Ground motion generated by certain underground nuclear explosions at the Nevada Test Site and recorded at the Engine Test Stand (Station ETS-1) exhibits a level of response higher than the level which would normally be expected on the basis of average experience. Although the specific cause of this anomalous response is presently not clear, refined techniques have been developed for making ground motion predictions. Characteristics of the anomaly

include a spectrum unusually enriched in high frequency (3-5 Hz) components and velocity and acceleration seismograms having pulse-like first arrivals with a peak vector amplitude considerably greater than typically observed at that distance for stations with similar geologic settings. The anomalous response is greatest at ETS-1 and decreases in all directions away from it. Analysis of observed data suggests that the anomaly is related to physical parameters of the travel path rather than solely to parameters of the source or receiving station environments. Author (NSA)

N71-21782# Illinois Univ., Urbana. Water Resources Center.
THE EFFECT OF RAINDROP IMPACT AND SURFACE ROUGHNESS ON SHEET FLOW Final Report
Harry G. Wenzel, Jr. Sep. 1970 126 p refs
(Contract DI-14-01-0001-1499)
(PB-196664; WRC-RR-34) Avail: NTIS CSCL 08H

Spectral analysis of the turbulent measurements indicates that the rainfall shifts the turbulent energy to higher frequencies than would be the case without rainfall. Analysis of the flow over rough surfaces shows that rainfall has little effect on resistance beyond the transition region and the transition point may be lowered by the presence of rainfall. A separate study of a single drop striking a stagnant water layer shows that the velocity and pressure field can be computed using a synthetic cell fluid scheme to solve the Navier-Stokes equations for this case. A dimensionless maximum impact pressure model was developed and it was found that surface tension is significant, the diameter of the region of disturbance was approximately one inch, and that locally high shear stresses are generated. These stresses could easily cause soil erosion. Author (GRA)

N71-21834# Ionospharen-Institut Breisach (West Germany).
IONOSPHERE DATA, VERTICAL-ECHO-SOUNDING: FREIBURG, URSI-CODE 131, DECEMBER 1970 [IONOSPHAEREN-DATEN, VERTIKAL-ECHO-LOTUNG: FREIBURG, URSI-CODE 131, DEZEMBER 1970]
Dec. 1970 43 p refs In GERMAN and ENGLISH
(Rept-294-F) Avail: NTIS

Hourly ionospheric propagation data are tabulated for December 1970. N.E.N.

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N71-20614# National Bureau of Standards, Washington, D.C. Electronic Technology Div.
DETERMINATION OF DEEP IMPURITIES IN SILICON AND GERMANIUM BY INFRARED PHOTOCONDUCTIVITY
W. Robert Thurber Mar. 1971 16 p refs Sponsored in part by AEC
(NBS-TN-570) Avail: SOD $0.25

The feasibility of using infrared photoresponse and photoconductivity measurements to study deep impurities in germanium and silicon is examined by reviewing the literature. It is concluded that photoconductivity is useful in detecting the presence of specific impurities because each impurity has a long wavelength cut off in response associated with its ionization energy. However, when there are several deep impurities in the same specimen, it is difficult to be certain of detecting each one because some have broad cut offs and many have nearly the same ionization energies. Photoconductivity as a general technique has serious limitations for determining the total concentration of deep impurities. The equations for determining impurity concentration from the magnitude of the photoconductivity signal depend on the relative influence of deep and shallow centers. Equations are derived for several situations and experimental results from the literature are discussed for each one. Author

N71-20635# Kiruna Geophysical Observatory (Sweden).
ON THE PROPERTIES OF CYLINDRICAL ELECTROSTATIC ANALYSERS IN ROCKET AND SATELLITE INSTRUMENTS
W. Riedler Oct. 1970 39 p refs
(KGO-Preprint-70-311) Avail: NTIS

A theoretical treatment of cylindrical electrostatic analyzers is given, with special reference to their use in rocket or satellite instruments. Formulas for conversion factors, acceptance angles, and energy bandwidths are derived. Author (ESRO)

N71-20736# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A METHOD FOR ANALYZING IMAGE DISTORTION IN DIFFRACTION TOPOGRAPHS
P. W. Kingman Dec. 1970 17 p refs
(AD-717006; BRL-1517) Avail: NTIS CSCL 14/5

The geometry of image distortion in diffraction topographs can be analyzed with complete generality by considering the mapping between the topograph and the true surface configuration as an affine transformation on a two dimensional manifold, as described by the relation z to the kth power = ((D sub K) to the kth power) (Z to the Kth power). By analogy with classical finite strain analysis; it is seen that when D is known, the true spatial configuration can always be extracted from the distorted image, and conversely, if the configuration of a set of base vectors in both images is specified, the components of D can be determined. An experimental procedure based upon this analysis has been developed and applied to the identification of multiple slip and kink traces in oblique Berg-Barrett topographs of polished metallographic samples. Author (GRA)

N71-20738# Battelle-Northwest, Richland, Wash.
SOLID STATE X-RAY ALPHA COINCIDENCE COUNTER
K. L. Swinth [1970] 21 p refs Presented at IEEE Nucl. Sci. Symp., New York
(Contract AT(45-1)-1830)
(BNWL-SA-1514; CONF-701109-5) Avail: NTIS

A system using solid state detectors has been developed for laboratory measurements of X-ray to alpha ratios emitted in the decay of transuranic elements. The system uses a coaxial geometry with the alpha detector sandwiched between the source and the X-ray detector. A lithium drifted silicon detector cooled to liquid nitrogen temperature is used for X-ray detection and a totally depleted surface barrier device is used as alpha detector. Sources are electrodeposited on stainless steel and placed between both detectors. Standard coincidence gating of the analyzer on the various alpha energy peaks obtained an X/alpha ratio of 0.046 for pure Pu-239 as compared to 0.048 obtained by a NaI(Tl) proportional counter scintillation system. G.G.

N71-20741* Pratt and Whitney Aircraft, East Hartford, Conn.
VAPOR PRESSURE MEASURING SYSTEM AND METHOD Patent
Vance D. Baker, inventor (to NASA) Issued 2 Jan. 1968 (Filed 14 Dec. 1964) 4 p Cl. 73-29 Sponsored by NASA
(NASA-Case-XMS-01618; US-Patent-3,360,980; US-Patent-Appl-SN-418362) Avail: US Patent Office CSCL 14B

A method and apparatus for measuring the partial pressure

of water vapor in a gas are described. Utilized is a tank wherein a sample of mixed gases is confined, a water injector on the tank for introducing water into the gases to saturate the sample, a manometer attached to the tank for measuring pressure before and after the sample is saturated, and temperature probes in the tank for measuring any temperature changes therein. By applying appropriate steam charts, the pressure increase and the temperature differential can be used to obtain the sample's water vapor pressure before the water is injected.

Official Gazette of the U.S. Patent Office

N71-20752# Kiruna Geophysical Observatory (Sweden).

CALIBRATION OF A SATELLITE EXPERIMENT FOR AURORAL PARTICLES AND SOME RELEVANT PROPERTIES OF THE CHANNEL MULTIPLIER DETECTORS

Peter Christophersen Oct. 1970 38 p refs Sponsored by Swed. Nat. Sci. Res. Council and Swed. Board for Tech. Develop.
(KGO-Preprint-70-312) Avail: NTIS

A particle spectrometer designed for auroral studies was flown on the ESRO 1A and the ESRO 1B satellites. This instrument makes use of electrostatic analyzers and 12 channel multipliers and is briefly described. The need for calibration of the spectrometer channels is pointed out and general relations between an incident particle flux and the resulting count rate are discussed. Experimental procedures and instrumentation for carrying out calibrations are described and results presented in tables and curves. Values for the calibration constants are found in the range from 0.02 to 3.00 x 10 to the minus 4th power . ster . keV cts/particle. Reasons for the large variations are discussed and special problems concerning the calibration of proton channels are dealt with. Author (ESRO)

N71-20856# European Space Research and Technology Center, Noordwijk (Netherlands). Space Science Dept.

ON THE ION FEEDBACK IN A STRAIGHT CHANNEL MULTIPLIER

R. D. Andresen and D. E. Page 1970 6 p refs Submitted for publication
Avail: NTIS

Experimental results are presented demonstrating by direct measurement the existence of positively charged particles produced within straight channel multipliers. These ions control the electron multiplication process of such detectors. Author (ESRO)

N71-20862# Naval Electronics Lab. Center for Command Control and Communications, San Diego, Calif.

COHERENT OPTICAL PROCESSING OF MOTION-DEGRADED IMAGES Research and Development Report, Oct. 1968–Jul. 1969

M. A. Monahan 26 Aug. 1970 53 p refs
(AD-716779; NELC-TR-1720) Avail: NTIS CSCL 14/5

A technique is described whereby a photograph of a given scene, degraded by linear image motion during exposure, can be, in the absence of noise, restored to an ideal geometrical image. The technique is based upon the principles of linear systems theory. Therefore an optical imaging system is shown to be, under appropriate conditions, a linear and space-invariant system. With coherent illumination, such an optical system performs a linear mapping of complex amplitude between the object and image planes whereas, under incoherent illumination, it is a linear mapping of intensity. It is also shown that a positive lens is capable of displaying, under coherent illumination, the spatial spectrum or Fourier transform of a given two-dimensional object function. The impulse response and transfer functions associated with linear image motion are described. With the degraded photograph as the input to a coherent processing system, in which the spectrum of the input is displayed at some intermediate plane, a filter is designed which, when inserted into that plane, modifies the transfer function. As a result, the output image more closely resembles the ideal geometrical image. As a test of the theory a long narrow slit, simulating the photograph of a moving point, was used as the input to a processing system. The resulting output image was a pair of point images separated by a distance equal to the length of the slit. Thus for the particular filter used, an arbitrary smeared input function would yield an output comprising two restored images whose centers are separated by the amount of linear image motion.

Author (GRA)

N71-20894# RAND Corp., Santa Monica, Calif.

A PHOTOGRAPHIC TECHNIQUE FOR IMAGE ENHANCEMENT: PSEUDOCOLOR THREE SEPARATION PROCESS

R. H. Stratton and J. J. Sheppard, Jr. Oct. 1970 54 p refs
(Contract F44620-67-C-0045)
(AD-717143; R-696-PR) Avail: NTIS CSCL 14/5

The use of pseudocolor transformations for the enhancement of black-and-white photographic images has a wide range of potential applications, including both tactical and strategic reconnaissance. The Report describes a simple and relatively inexpensive method of producing pseudocolor transformations by a photographic procedure in which three intermediate separations are obtained from a black-and-white original and then successively printed on color material. The density range and contrast of the separations are controlled by selectively varying the materials used, the exposure, and the processing technique. The final appearance of the pseudocolor transformation is then determined by an appropriate selection of filters and exposures during the successive printing, in register, of the three separations on color material. The principal result of the present work is that the proposed three-separation technique has been shown to produce a range of pseudo-color transformations which have potential for the enhancement of a variety of military and biomedical images.

Author (GRA)

N71-21006# Kiruna Geophysical Observatory (Sweden).

A SATELLITE INSTRUMENT FOR AURORAL PARTICLE MEASUREMENTS USING CHANNEL MULTIPLIERS

W. Riedler, B. Hultqvist, and S. Olsen Oct. 1970 31 p refs Sponsored in part by Swed. Nat. Sci. Res. Council and Swed. Board for Tech. Develop.
(KGO-Preprint-70-310) Avail: NTIS

An instrument is described, which is designed to measure auroral electron and proton spectra in the 1 to 13 keV range at two pitch angles. It makes use of electrostatic analyzers and channel multipliers. The instrument has been successfully flown on the satellites ESRO 1A (Aurorae) and ESRO 1B (Boreas).

Author (ESRO)

N71-21008* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EVENT RECORDER Patent

James M. Russell, III and William E. Fox, inventors (to NASA) Issued 21 Nov. 1967 (Filed 30 Dec. 1965) 3 p Cl. 346-50
(NASA-Case-XLA-01832; US-Patent-3,354,462;
US-Patent-Appl-SN-517858) Avail: US Patent Office CSCL 14B

An event recorder with a constant speed motor which rotates a recording disc is described. An ignitable coated wire that produces carbon when subjected to an electrical current is positioned immediately above the recording disc. When an event occurs, a current is energized causing carbon to be deposited on the disc. The angular position of the carbon spot with respect to a known reference mark indicates the time of the event.

Official Gazette of the U.S. Patent Office

N71-21007* United Aircraft Corp., East Hartford, Conn.
SPHERICAL TANK GAUGE Patent
Harvey A. Smith, inventor (to NASA) Issued 5 Dec. 1967 (Filed 26 Aug. 1965) 3 p Cl. 73-290 Sponsored by NASA
(NASA-Case-XMS-06236; US-Patent-3,355,948;
US-Patent-Appl-SN-482670) Avail: US Patent Office CSCL 14B

A gauge is described for measuring the quantity of liquid in a spherical tank located in a reduced gravity atmosphere. It includes a flexible bladder mounted internally across the tank, and a retractable measuring stick attached to the center of the bladder, and extends through an opening in the tank. Circular rigid hoops are mounted on the bladder coaxially with the center line of the tank for stabilizing the bladder.

Official Gazette of the U.S. Patent Office

N71-21018# Princeton Univ., N.J. Dept. of Physics.
PERFORMANCE OF A LARGE VOLUME TWO PHOTOTUBE NEUTRON DETECTOR
J. T. Dakin, M. G. Hauser, M. N. Kriesler, and R. E. Mischke 2 Dec. 1970 21 p refs
(Contract AT(30-1)-4159)
(PURC-4159-13; TR-4) Avail: NTIS

Construction and performance of a liquid-scintillation counter having 5 in. diam phototubes at each end is reported. An array of these detectors was developed to detect neutrons in negative pion + proton yields neutron plus (neutral missing mass) interactions for an experiment studying decays of the omega (783 MeV) and eta (958 MeV) mesons. When used for detection of 50 to 300 MeV neutrons, the system had a time-of-flight resolution of 2 nsec position resolution varying between 2 and 8 in. depending on the amount of scintillation light, and detection efficiency of 14% when operated at a light threshold of about 8 MeV electron energy.

Author (NSA)

N71-21039# European Space Research and Technology Center, Noordwijk (Netherlands). Space Science Dept.
A STRAIGHT CHANNEL MULTIPLIER USED AS A LOW-ENERGY ION SOURCE
R. D. Andresen and D. E. Page 1970 14 p refs Submitted for publication
Avail: NTIS

Experimental results are presented dealing with the energy distribution of positively charged ions occurring within straight channel multipliers. These ions are produced mainly at the positive potential end of the tube by interaction between cascade electrons and residual gas molecules inside the vacuum chamber. There exists a sharp decrease in the energy distribution of the ions corresponding to the applied high voltage of the straight channel multiplier.

Author (ESRO)

N71-21040* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
RADIATION DETECTOR READOUT SYSTEM Patent
Kenneth D. Cashion and Benny R. Baker, inventors (to NASA) Issued 12 Dec. 1967 (Filed 29 Dec. 1964) 4 p Cl. 250-207
(NASA-Case-XMS-03478; US-Patent-3,358,145;
US-Patent-Appl-SN-422100) Avail: US Patent Office CSCL 14B

An electrical circuit for determining the amount of light detected by a photomultiplier tube is described. It utilizes a highly stable variable current source which is combined with the "dark" current signal when no light signal is fed into a photomultiplier tube, and causes the resultant output signal of the circuit to be zero. When an input light signal is fed into the photomultiplier tube, with the current source connected to the circuit having a value equal to but opposite in polarity to the "dark" current of the photomultiplier tube, the resultant output signal is proportional to the input signal, and low intensity light signals may be readily measured by the circuit since the signal-to-noise ratio is substantially reduced.

Official Gazette of the U.S. Patent Office

N71-21072* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INERTIA DIAPHRAGM PRESSURE TRANSDUCER Patent
Henry L. B. Seegmiller, inventor (to NASA) Issued 14 Nov. 1967 (Filed 17 Jun. 1965) 5 p Cl. 73-398
(NASA-Case-XAC-02981; US-Patent-3,352,157;
US-Patent-Appl-SN-464879) Avail: US Patent Office CSCL 14B

A pressure transducer is described in which a diaphragm is substantially freely supported so that the motion of the diaphragm during the test period is resisted primarily only by the inertia of the diaphragm with relatively little resistance due to any elastic or spring return force in the diaphragm. The motion of the diaphragm, when subjected to a fluid force, is sensed and recorded directly from the movement of the diaphragm while the diaphragm is in motion and as a function of time. The acceleration of the diaphragm is thereby detected and recorded.

Official Gazette of the U.S. Patent Office

N71-21079* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ELLIPSOGRAPH FOR PANTOGRAPH Patent
La Vern E. Winn, inventor (to NASA) Issued 23 Jan. 1968 (Filed 29 Aug. 1966) 4 p Cl. 33-31
(NASA-Case-XLA-03102; US-Patent-3,364,578;
US-Patent-Appl-SN-576195) Avail: US Patent Office CSCL 14B

An ellipsograph that is capable of defining ellipses with minimal axial dimensions is described. The ellipsograph is used with a pantograph cutter to permit cutting of ellipses from various materials. The apparatus is simple in construction and operation, and can be readily dismantled for storage.

E.H.W.

N71-21082* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REACTION WHEEL SCANNER Patent
Gerald I. Goldberg, inventor (to NASA) Issued 31 Oct. 1967 (Filed 21 Oct. 1965) 7 p Cl. 244-1
(NASA-Case-XGS-02629; US-Patent-3,350,033;
US-Patent-Appl-SN-500435) Avail: US Patent Office CSCL 14B

A satellite stabilization apparatus in which the function of a reaction wheel stabilizer and an optical horizon scanner are combined in a single device is described. The flywheel, as an integral part of the reaction wheel, produces the rotation of the scan means and of the stationary parts of the optical scanner within the shaft of the flywheel. A salient feature is the great efficiency afforded with respect to weight, power consumption, volume, and reliability by elimination of gear trains, motors, bearings, and other components.

Official Gazette of the U.S. Patent Office

N71-21088* Barnes Engineering Co., Stanford, Conn.
HORIZON SENSOR WITH A PLURALITY OF FIXEDLY POSITIONED RADIATION COMPENSATED RADIATION SENSITIVE DETECTORS Patent
John M. McLauchlan and Monty M. Merlen, inventors (to NASA) Issued 17 Oct. 1967 (Filed 23 Oct. 1964) 14 p Cl. 250-83.3 Sponsored by NASA
(NASA-Case-XNP-06957; US-Patent-3,348,048;
US-Patent-Appl-SN-406097) Avail: US Patent Office CSCL 14B

A horizon sensor is described in which a mosaic array of spaced thermopile, infrared radiation detectors is sequentially sampled and which in ordinary operation at least some detectors view space. The detectors give a zero output signal if the radiation received by the detector equals the radiation from the detector. Digital operation is used to determine when horizon crossing

occurs by the number of detectors sampled rather than by signal amplitudes. Diagrams including effective scan paths on a planet, a section through a scanning head, a cross section of the optics and circuitry involved, and the switching matrix are presented. J.M.

N71-21090* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRESSURE MONITORING WITH A PLURALITY OF IONIZATION GAUGES CONTROLLED AT A CENTRAL LOCATION Patent
Robert C. Finke, inventor (to NASA) Issued 10 Oct. 1967 (Filed 12 Dec. 1963) 5 p Cl. 324-33
(NASA-Case-XLE-00787; US-Patent-3,346,806; US-Patent-Appl-SN-330210) Avail: US Patent Office CSCL 14B

An ionization gage control system is described for a plurality of separately located ion gage tubes mounted on a vacuum chamber for sensing the chamber pressure at various locations. Each ion gage is provided with a remote station box containing a filament heating transformer and a grid outgassing transformer with related controls. The primary coils of the transformers are connected to a centrally located master switch panel and ion gage controller. The remote station box furnishes standby heating to both the ion tube filament and grid enabling them to be raised to the operating temperature for taking readings at any time. The control system extends the ion tube life and keeps them clean by reducing condensation within the tube. A block diagram of the system and a wiring diagram of a remote station box are included. J.M.

N71-21091* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MINIATURE STRESS TRANSDUCER Patent
Anthony San Miguel and Robert H. Silver, inventors (to NASA) Issued 7 Nov. 1967 (Filed 29 Oct. 1964) 5 p Cl. 73-88.5 Sponsored by NASA
(NASA-Case-XNP-02983; US-Patent-3,350,926; US-Patent-Appl-SN-407599) Avail: US Patent Office CSCL 14B

A miniature solid state, direction-sensitive, stress transducer is described which employs a bonded semiconductive piezoresistive element embedded within the transducer to minimize any strain effects and which senses internal stresses along selected directions at a selected point. A small piezoresistive crystal or filament of a semiconductive material, such as silicon which is grown so that it only changes resistivity when stress is applied along a particular axis, is used at the sensing element. The element is housed in an etched Teflon material which limits the directional change of the housing and increases the range of stress forces which may be applied to the element without breakage. Output leads which connect the element to other instruments used to measure and record the change in the element resistivity are outlined. A sectional view of the transducer and isometric views of the transducer and mountings are included. J.M.

N71-21098*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
COMPILATION OF XENON FLASH TUBE DATA FOR PILOT WARNING INDICATOR SYSTEMS
Robert Gagnon and Anthony R. Lewis Washington Mar. 1971 15 p refs
(NASA-TN-D-6272; C-125) Avail: NTIS CSCL 01D

To provide design data for pilot warning indicator systems, the characteristics were measured of six types of xenon strobe lamps built to operate as aircraft beacons and one type of xenon strobe lamp which was not designed for that purpose. Flash lamp output was measured with a radiometer, factory-calibrated against a secondary standard. Four filters (central wavelengths 0.825, 0.876, 0.927, and 0.974 microns) were used to obtain more detailed spectral characteristics. Properties determined for each lamp were: pulse shape, pulse width, pulse rise time, lamp steradiancy, peak irradiance, peak radiant intensity, peak optical power, average optical power, optical energy output, and conversion efficiency. Author

N71-21112*# Space Sciences, Inc., Waltham, Mass.
A NON-PROTRUDING CONDUCTIVITY PROBE SYSTEM FOR REENTRY PLASMA DIAGNOSTICS
Sol Aisenberg and Kuo Wei Chang *In* NASA. Langley Res. Center The Entry Plasma Sheath and its Effects on Space Vehicle Electromagnetic Systems, Vol. 1 1970 p 203-217 refs (See N71-21101 10-25)
(Contract F19628-68-C-0127)
Avail: NTIS HC $9.00/MF $0.95 CSCL 14B

A rugged RF conductivity coil system was constructed which utilizes a sensitive marginal oscillator to measure the changes of coil Q and inductance, which are closely related to the plasma conductivity. Since the marginal oscillator is constantly on resonance and is sensitive to slight changes in coil Q, this approach is superior to the impedance bridge method. The system was calibrated over a wide dynamic range of conductivity and was tested in a simulated reentry plasma. A coaxial multicoil system capable of measuring the spatial variation of plasma conductivity is also described. Author

N71-21148 California Univ., Berkeley.
HIGH-ENERGY NEUTRON SPECTROSCOPY WITH ACTIVATION DETECTORS, INCORPORATING NEW METHODS FOR THE ANALYSIS OF Ge(Li) GAMMA-RAY SPECTRA AND THE SOLUTION OF FREDHOLM INTEGRAL EQUATIONS
Jorma Tapio Routti (Ph.D. Thesis) 1969 161 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 70-6205

The use of high-resolution gamma spectroscopy with Ge(Li) detector systems was incorporated to the measurement of induced activities. A method for the automatic analysis by computer of semiconductor gamma-ray spectra is described. The application of this method which is based upon the study of photopeaks in the spectra, and the associated computer program is discussed in terms of general gamma spectroscopy. The detector systems considered include conventional threshold detectors, Bonner spheres, and recoil spectroscopy with emulsions. In the determination of the neutron spectrum from measured activities two numerical methods for the solution of the first order Fredholm integral equation are described; a generalized least-squares technique with matrix inversion and an iterative least-squares method with nonnegative solution. Dissert. Abstr.

N71-21149# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ONE METHOD OF CONSTRUCTING A LARGE NUMBER OF ASSOCIATIVE PERCEPTRON ELEMENTS
L. V. Klykov et al 26 Oct. 1970 13 p refs Transl. into ENGLISH from the Russian
(AD-717056; FTD-HC-23-1418-68) Avail: NTIS CSCL 9/2

A method of constructing a large number of associative elements (A-elements) which are used to realize an operating model of a perceptron for the recognition of photograph patterns is described. The purpose of the work was to develop an engineering device with a high operating speed. Author (GRA)

N71-21220*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IMP 1 OPTICAL ASPECT SYSTEM
E. John Pyle Washington Mar. 1971 66 p
(NASA-TN-D-7008; G-993) Avail: NTIS CSCL 20F

Two detectors were used to obtain information from the

sun and the sunlit earth. A digital solar sensor that performed an optical analog-to-digital conversion was used to measure the elevation and azimuth angles of the solar disk. Information on the sunlit earth was obtained by the use of a visible-horizon detector. The logic system necessary to collect, process, and store information from the two detectors is presented and discussed. Sun-line crossing, detected by the solar sensor, was used to generate an onboard clock signal synchronized to the spacecraft rotation rate. The spin synchronous clock, which divides the spin period into 128 intervals, is also presented and discussed. Author

N71-21353*# Test Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACECRAFT DATA SYSTEMS
In its Space Programs Sum. No. 37-66, Vol. 3. Oct.–Nov. 1970 31 Dec. 1970 p 160–170 refs (See N71-21338 10-30)
Copyright. Avail: NTIS CSCL 14C

The effects of various materials on the head-to-tape interface in a spacecraft magnetic recorder were studied. The implementation of m-ary linear feedback shift registers with binary devices is described. Graphic-theoretical definitions are used to extract complete subgraphs of the command prefix code for TOPS; the criterion for prefix selection is the shortest possible sequence capable of being recognized by the command decoder even if the prefix has been corrupted by the noisy channel. Approximative calculations are performed on the relative weights of damages produced by electrons from the Jupiter radiation belt in metal oxide semiconductor structures. It was found that for currently projected outer planet missions, Jupiter's electron induced ionization dose in MOS structures behind a 50 mils thick magnesium wall does not exceed 2 times 10,000 rad; bremsstrahlung is less than 30 of the total dosage. G.G.

N71-21445# Michigan Univ., Ann Arbor. Willow Run Labs.
INVESTIGATION OF MULTISPECTRAL DISCRIMINATION TECHNIQUES
R. F. Nalepka Jan. 1970 199 p refs Original Contains Color Illustration
(Contract USDA-12-14-100-9548(20))
(Rept-2264-12-F) Avail: NTIS

The improvement multispectral discrimination techniques for remote sensing in agriculture is discussed. Investigations included the recognition processing of wheat and the study of certain preprocessing transformations to reduce the deleterious effects of changing illumination and source-target-sensor aspect angles. Comparison of photographic and multispectral data collected over Imperial Valley, California, is outlined. An analysis is summarized of data calibration, the effects of atmospheric scattering, and the use of predictive models. Author

N71-21446# Michigan Univ., Ann Arbor. Willow Run Labs.
MULTISPECTRAL REMOTE SENSING OF URBAN FEATURES Final Report, 1 Jun.–31 Oct. 1969
J. E. Colwell Mar. 1970 27 p refs Original contains color illustrations
(Contract USGS-14-08-0001-11968)
(Rept-2772-6-F) Avail: Issuing Activity

The potential of multispectral remote sensing in aiding the study of changing urban watershed characteristics resulting from fluctuations in the materials comprising the watershed was investigated. Multispectral data was collected in three separate sets, each containing information from different spectral regions. The data was processed on special-purpose analog and digital computers, and the results are presented in the form of recognition maps, resolution-element counts, and mean reflectance spectra. The spectral interval from 1.0 to 5.5 micrometers provided the most promising single data set. Results suggest that information concerning the area and distribution of the materials present in an urban scene can be most reliably and completely obtained by the simultaneous processing of both reflected and emitted data. Author

N71-21467*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
LUNAR GRAVIMETER Interim Study Report
J. B. Harper and Sheldon Buck, comp. Aug. 1970 67 p ref
(Contract NAS9-10749; DSR Proj. 55-42200)
(NASA-CR-114946; E-2535) Avail: NTIS CSCL 14B

The development of a gravimeter for a lunar traverse gravity experiment is discussed. The conceptual design of a simple, light-weight low-power instrument resulting from the initial study effort is described. Special sections detail the oven structure, thermal analysis, and the electronic subsystems. Preliminary specifications are included for the instrument, operation, and the experiment error budget. The entirely self-contained gravimeter features a digital readout, simplicity in both mechanical and electrical design, and 1-milligal accuracy. Electronic power consumption has been minimized, and a 100 watt-hour battery contained within the instrument meets our requirements. This instrument concept considers a manually course-erected system using a 3-degree bubble level as a reference. The remaining alignment error is eliminated by an internal passive pendulum. Author

N71-21469*# Electro-Optical Systems, Inc., Pasadena, Calif.
SOLAR WIND MASS SPECTROGRAPH Final Report, 12 Aug. 1969–12 Aug. 1970
Lawnie Taylor 31 Dec. 1970 79 p refs
(Contract NAS9-9909)
(NASA-CR-114948; EOS-4044) Avail: NTIS CSCL 14B

The engineering and performance specifications obtained for a solar wind mass charge spectrograph and a solar wind direction indicator are presented. The spectrograph developed in this program is a miniaturized double-focusing instrument designed to demonstrate the feasibility of measuring photographically the mass/charge number composition of the solar wind with a high degree of resolution and sensitivity. The unit is primarily designed to measure mass/charge numbers in the range 1.5 to 4.7; however, it is not limited to this range. The direction indicator is a self-contained instrument which has been designed to demonstrate the feasibility of determining attitude with respect to the flow direction of an incident ion beam over a range of angles from 15 deg to 0.25 deg within an accuracy of 5 percent. The instrument can provide an Apollo astronaut with the capability of adjusting the roll and pitch of the spacecraft within + or − 0.5 deg of the solar wind mean direction. Author

N71-21516# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
SOME OPERATIONAL CHARACTERISTICS OF HOT FILM WATER VELOCITY SENSORS
K. M. Foreman Mar. 1971 29 p refs Presented at the Symp. on Flow: Its Meas. and Control in Sci. and Ind. of the AIP, ISA, ASME, NBS Conf., Pittsburgh, 10–14 May 1971
(RM-501J) Avail: NTIS

Progress in a program to develop hot film velocity sensors for ocean and coastal waters is summarized. Three sensors were installed on the research submersible BEN FRANKLIN during its 30-day Gulf Stream Drift Mission in July 1969. After approximately 830 hours of submergence and about 260 hours of surface tow, the sensors were still in operational condition. During February and March, 1970, active-mode tests of modified sensors were conducted in conjunction with the BEN FRANKLIN missions off the Florida coast. Malfunction occurred after approximately 50 hours of underwater tests. A scanning electron microscope study showed that the Teflon coating of the modified sensors had considerably

greater microporosity density than the coating of the original lot. Recommendations are made for future sensor development. Author

N71-21590# Lockheed Missiles and Space Co., Palo Alto, Calif.
INFRARED RADIOMETER WITH HEAT STABILIZED OPTICAL HEAD
A. A. Sivkov et al [1970] 5 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), v. 13, no. 9, 1970 p 92–96
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

An infrared radiometer is described whose schematic and the construction of the optical portion assure stability of the optical and electrical parameters of its optical elements, which in turn permits raising the measurement accuracy. Results are presented of some investigations of the operation of the optico-mechanical part of the radiometer. Author

N71-21596# Tomorrow Enterprises, Portsmouth, Ohio.
INVESTIGATION OF ULTRASONIC NEBULIZATION FOR ATOMIC ABSORPTION SPECTROPHOTOMETRY Final Report, 1 Apr. 1969–31 Jul. 1970
Louis E. Owen Wright-Patterson AFB, Ohio AFML Nov. 1970 25 p
(Contract F33615-69-C-1409)
(AD-717189; AFML-TR-70-220) Avail: NTIS CSCL 7/4

An ultrasonic sample nebulizing system for atomic absorption spectrophotometry was assembled following studies which increased appreciation of the limiting factors in powering piezoelectric elements for surface nebulization. In the system, a sample solution is pumped to the vibrating face of a piezoelectric disc and the resulting aerosol is removed by a sweep gas. Nebulization efficiency is relatively independent of the sweep gas flow rate. Author (GRA)

N71-21678# Boeing Co., Seattle, Wash. Aerospace Group.
ELECTRONIC SIGNAL PROCESSING TECHNIQUES. PHASE 2: NONDESTRUCTIVE TESTING Annual Report, 30 Oct. 1969–29 Oct. 1970
James C. Kennedy and Wayne E. Woodmansee Nov. 1970 85 p refs
(Contract DAAA25-69-C-0206; ARPA Order 1246)
(AD-716803; D180-10589-1) Avail: NTIS CSCL 14/2

Signal averaging was used to enhance flaw indications in the ultrasonic inspection of electron beams welds. An electronic gate, synchronized to the transducer motion through the use of an electrically controllable delay was also used to enhance flaw indications. To aid in electrical signal processing, a technique for recording ultrasonic video information on a low-frequency tape recorder was developed. In preparation for optical matched filtering, ultrasonic information was recorded on a photographic transparency in a C-scan format. An XY scanning densitometer was constructed to remove the intensity modulated information from the film and to aid in the production of hard copy recordings. Phaselock detection was used to perform through transmission eddy current testing. Methods were developed for obtaining quantitative through transmission data. Through transmission thickness measurements were performed and procedures were developed for obtaining a linear relationship between part thickness and eddy current signal. Applications to chemical milling and in-motion thickness measurements were demonstrated. Phaselock detection and signal averaging were used to measure resistance and inductance changes in conventional eddy current coils during a scanning operation. Quantitative data were produced from bridge unbalance signals. Author (GRA)

N71-21679# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
INTERCOMPARISON OF PORTABLE RADIATION MONITORING INSTRUMENT EVALUATIONS
I. M. G. Thompson, H. V. Larson, and R. L. Kathren [1970] 50 p refs Presented at the Symp. on New Develop. in Phys. and Biol. Radiation Detectors, Vienna Sponsored by AEC
(BNWL-SA-3565; CONF-701112-2) Avail: NTIS

The evaluation procedures and results of the comparison of radiation protection instruments from Berkeley Nuclear Laboratories in the United Kingdom and the Pacific Northwest Laboratory of Battelle Memorial Institute are discussed. A low-level exposure ratemeter consisting of an energy-compensated G–M detector; a Cutie Pie beta–photon survey meter (ionization chamber); a neutron dose-equivalent ratemeter consisting of a spherical helium 3 proportional detector in a polyethylene sphere; and a neutron dose-equivalent ratemeter consisting of a cyclindrical boron trifluoride proportional detector in a polyethylene moderator were studied. NSA

N71-21689*# Arizona Univ., Tucson. Optical Sciences Center.
APOLLO 9 MULTIBAND PHOTOGRAPHY EXPERIMENT S065 Interim Post-Flight Calibration Report
P. B. Keenan, R. A. Schowengerdt, and P. N. Slater 15 Jun. 1970 14 p refs
(Contract NAS9-9333)
(NASA-CR-117501; TM-2) Avail: NTIS CSCL 14E

The spectral analysis of the cameras and filters used in the Apollo 9 S065 multiband photography experiment is outlined. Some additional data on registration errors, film flatness, format size, and resolution are included. The spectral transmittance measurements, registration and image height errors, and resolution measurements made with the complete camera system are summarized. Author

N71-21716# Rutgers Univ., New Brunswick, N.J. Dept. of Mechanical and Aerospace Engineering.
A DESCRIPTION AND ANALYSIS OF THE WOLLASTON PRISM SCHLIEREN-INTERFEROMETER Interim Report
Richard D. Small Jul. 1970 38 p refs
(Contract F44620-68-C-0018; Proj. Themis)
(AD-716861; RU-TR-134-MAE-F; AFOSR-70-2497TR) Avail: NTIS CSCL 20/6

A Wollaston prism Schlieren-Interferometer is described and analyzed. This Schlieren-Interferometer is a standard single pass Schlieren system with the knife edge replaced by a polarizer-Wollaston prism-analyzer combination. The analysis of the optical system shows that a fringe shift on the viewing screen is related to a density change. The effects of the polarizer, Wollaston prism, and analyzer are included in the analysis. The double image, which is characteristic of a Wollaston prism, and its influence on interferogram interpretation is discussed. It is shown that the fringe shift may be related to a density gradient under certain special conditions. The experimental procedures developed for the use of this instrument are briefly reviewed. Author (GRA)

N71-21737# Mound Lab., Miamisburg, Ohio.
APOLLO APPLICATIONS PROGRAM (ATM) UV MIRROR/GRATING RADIOISOTOPE HEATERS FABRICATION
W. C. Wyder 8 Jan. 1971 10 p
(Contract AT(33-1)-GEN-53)
(MLM-1779) Avail: NTIS

A summary is presented of the work performed on the fabrication of the Ta-10 wt % W inner liners for the 0.02-W source, and the Ta-10 wt % W inner liners and outer strength members for the 0.50-W source. Die dimensions, part dimensions, and recommendations for improvements are given. Author (NSA)

N71-21745 National Lending Library for Science and Technology, Boston Spa (England).
NEW SOVIET TELESCOPE, THE LARGEST IN EUROPE
B. K. Ioannisiani et al 23 Apr. 1970 7 p Transl. into ENGLISH from Pravada (Moscow), 20 Feb. 1961 p 5–8
(NLL-RRE-Trans-222-(8036.625)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A high accuracy, optical mechanical telescope was designed and constructed with emphasis on easy control and convenient operation. Emphasis was also given to magnitude and direction changes of the weight distribution that occurs during operation, mechanical stiffness, and temperature stability of each element as well as the whole system. The telescope is equipped with auxiliary systems enabling the focal length of the mirror to be changed, and the study of celestial body images using photographic, photometric, and spectral analyses. E.H.W.

N71-21747# Lockheed Missiles and Space Co., Palo Alto, Calif.
FLOATING INTEGRATING GYROSCOPE WITH FEEDBACK
R. A. Abramov [1971] 3 p ref Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), no. 9, 1970 p 69–71
Avail: NTIS; National Translations Center, John Crerar Library, Chciago, Ill. 60616

The possibility of raising the accuracy of a gyrostabilizer with two degrees of freedom floating integrating gyroscopes having feedback in the reactive moment of the gyro-connection is shown. The gyrostabilizer is improved by applying feedback in the reactive moment of the gyro-connection. Author

N71-21842# National Environmental Satellite Center, Washington, D.C.
CALCULATION OF CLEAR COLUMN RADIANCES USING AIRBORNE INFRARED TEMPERATURE PROFILE RADIOMETER MEASUREMENTS OVER PARTLY CLOUDY AREAS
William L. Smith Mar. 1971 18 p refs
(NOAA-TM-NESS-28) Avail: NTIS

In June 1970, a brassboard version of the infrared temperature profile radiometer was flown on the NASA Convair-990. This flight was made primarily to obtain measurements to test the hypothesis that radiance propagating from clear portions of a partly cloudy field could be calculated directly from the total radiance measurement over the field. Such clear column radiances are needed if one is to determine the temperature and water vapor profiles of the atmosphere to the earth's surface. Sample results presented show these calculations are feasible, and indicate that measurements from the medium resolution scanning radiometers to be used on future polar-orbiting satellites can be used to provide global soundings. Author

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N71-20684# Louvain Univ. (Belgium). Inst. of Mechanical Manufacturing.
NUMERICALLY CONTROLLED MACHINE PROGRAMMING: PROBLEM ANALYSIS AND SOME SOLUTIONS AVAILABLE IN BELGIUM IN 1970 [LA PROGRAMMATION DES MACHINES A COMMANDE NUMERIQUE: SYNTHESE DES PROBLEMES POSES ET QUELQUES SOLUTIONS DISPONIBLES EN BELGIQUE EN 1970]
P. Gaudissart Brussels Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal. Oct. 1970 92 p refs In FRENCH Sponsored by IRSIA
(CRIF-MC-35) Avail: NTIS

Basic principles used in manually programming numerical controlled machine tools are reviewed and the limits of the method discussed. Computer aided programming methods such as AUTOPROG, APT, EXAPT, and AUTOSTOP are then described. Use of time shared computers for programming of machine tools is examined. ESRO

N71-20703# Norske Veritas, Oslo. Materialteknisk Avdeling.
BRITTLENESS AND CRACK FORMATION OF STEEL CASTINGS: AN INVESTIGATION OF BRITTLENESS IN NON-ALLOY CAST STEEL [SPROEHET OG SPREKKDANNELSE I STOEPESTAEL: EN UNDERSOEKELSE AV SPROEHET I ET STOERRE AVSTOEP AV ULEGERT STOEPESTAEL]
T. Kristoffersen and G. Wold 11 Sep. 1969 20 p refs In NORWEGIAN; ENGLISH summary Sponsored by Roy. Norweg. Council for Sci. and Ind. Res.
Avail: NTIS

A casting which had been discarded because of surface fissures and internal defects detected by ultrasonic testing is examined. The aim was to find the cause of the internal defects and their influence on the mechanical properties of the steel. The steel had been produced in a basic electric furnace and ladle deoxidized with 1/2 kg aluminum per ton. For nitrogen fixation approximately 0.4 kg titanium per ton was added as FeTi. Author (ESRO)

N71-20739* General Electric Co., Philadelphia, Pa.
BISMUTH-LEAD COATINGS FOR GAS BEARINGS USED IN ATMOSPHERIC ENVIRONMENTS AND VACUUM CHAMBERS Patent
Luke J. Gabrovic and Harold M. Lampert, inventors (to NASA) Issued 19 Dec. 1967 (Filed 22 Oct. 1965) 3 p Cl. 308-9 Sponsored by NASA
(NASA-Case-XGS-02011; US-Patent-3,359,046; US-Patent-Appl-SN-502693) Avail: US Patent Office CSCL 13I

Gas bearings are rendered non-galling by providing coatings on their mating surfaces. One of the surfaces is provided with a film of bismuth and the other with a film of lead. When contacted by each other, the surfaces do not gall to form gross irregularities which would allow the gas support to channel and thereby destroy the bearings effectiveness.
Official Gazette of the U.S. Patent Office

N71-20740* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NULL DEVICE FOR HAND CONTROLLER Patent
John F. Newcomb, inventor (to NASA) Issued 23 Jan. 1968 (Filed 28 Dec. 1965) 5 p Cl. 74-471
(NASA-Case-XLA-01808; US-Patent-3,364,777; US-Patent-Appl-SN-517159) Avail: US Patent Office CSCL 13I

A mechanism for precisely returning a control rod to a null or neutral position is described that limits opposing movements of the spring members with respect to a reference structure. Pivoted members attached to a mount and a base plate transfer thumbscrew rotation into lateral movement of the plate at the same time as opposed resilient members mounted on the base plate prevent unsymmetrical movements of the resilient members. The control rod is provided with a rider element that acts against the resilient members when a control force is applied.
Official Gazette of the U.S. Patent Office

N71-20750# Louvain Univ. (Belgium). Inst. of Mechanical Manufacturing.

STEPPING MOTORS FOR NUMERICALLY CONTROLLED MACHINE TOOLS: INTRODUCTION TO THEIR CONSTRUCTION AND USE [LES MOTEURS PAS A PAS SUR MACHINES-OUTILS A COMMANDE NUMERIQUE: INTRODUCTION A LEUR CONSTITUTION ET A LEUR EMPLOI]

Jean Plas (Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal.) and Jan Blommaert (Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal.) Brussels Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal. Aug. 1970 76 p refs In FRENCH Sponsored by IRSIA

(CRIF-MC-33) Avail: NTIS

Stepping motors used for control of numerical machine tools can only provide limited power. To improve the capability of such motors to control heavier devices the addition of an hydraulic torque amplifier is discussed. The accuracy of the system is evaluated and results are applied to a milling machine. ESRO

N71-20751# Louvain Univ. (Belgium). Inst. of Mechanical Manufacturing.

PRODUCTIVITY DOUBLING OF DOWNWARDS GRINDING BY SPEED INCREASE OF THE GRINDING WHEEL [DOUBLEMENT DE LA PRODUCTIVITE DE LA RECTIFICATION EN PLONGEE PAR AUGMENTATION DE LA VITESSE DE MEULE]

A. Decneut (Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal.) and R. Snoeys Brussels Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal. Sep. 1970 25 p refs In FRENCH Sponsored by IRSIA

(CRIF-MC-34) Avail: NTIS

Tests were carried out to ascertain effects of a high tool speed on grinding machines. It was found that the surface roughness was improved by a higher speed with the vertical motion kept the same. Surface roughness increased with increasing vertical speed when the grinding wheel was fed forwards at 30 m/sec instead of 60 m/sec. ESRO

N71-20762# Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).

ACCEPTANCE REPORT OF TWO HEIDENHAIN TYPE ROD 7 INCREMENTAL ROTATING SENSORS HAVING AN ACCURACY 0.001 DEG [COMPTE RENDU DE RECEPTION DE DEUX CAPTEURS ROTATIFS INCREMENTAUX HEIDENHAIN TYP ROD 7 DE PRECISION 0,001 DEG]

16 Jul. 1970 54 p In FRENCH

(LRBA-PV-12-510/SEI) Avail: NTIS

Acceptance tests of two positioning devices for rotating shafts with a required accuracy greater than 5 second of arc on one revolution and greater than 1 second of arc for angles smaller than 1 degree are described. It was found that the devices met the first specification but not the second. ESRO

N71-20813* Honeywell, Inc., Minneapolis, Minn.

CLAMPING ASSEMBLY FOR INERTIAL COMPONENTS Patent

William P. Killalea, Daniel E. Danaci, and Clarence T. Pesek, inventors (to NASA) Issued 2 Jan. 1968 (Filed 27 Dec. 1966) 6 p Cl. 248-27 Sponsored by NASA

(NASA-Case-XMS-02184; US-Patent-3,361,400; US-Patent-Appl-SN-608247) Avail: US Patent Office CSCL 13E

A clamping assembly for inertial components is described. A hollow cylindrical receptable is mounted axially perpendicular to a base plate which is boltable to the platform in which the inertial components are to be mounted. The cylinder inner wall is formed with protrusions which mate with grooves in the exterior of the inertial component whereby the component is accurately oriented and precluded from rotation. A plurality of clamping shoes which are spring-biased outwardly from the cylinder are movable inwardly through windows of the cylinder by a flexible band which is constrained in a loop encompassing the clamp shoes, and is tightenable by a crank mechanism to move the shoes against the inertial component. By turning the crank to loosen the band, the constraint imposed on the springs urges the shoes outwardly to provide instantaneous release. The crank cooperates with an indicator with different colored faces which indicate whether the component is locked or unlocked, or whether the clamping assembly is in a transitional phase between clamping and non-clamping conditions. Official Gazette of the U.S. Patent Office

N71-20910# Norges Tekniske Hoegskole, Trondheim. Verkstedteknisk Lab.

WORKING DATA FOR TURNING PROCESSES: THE VALUE OF EDGE DURABILITY CRITERIA [UTVIKLING AV BEARBEIDINGSDATA FOR DREIING: EGGVARIGHETSKRITERIENNES UTSAGNSKRAFT]

A. Otterstad and K. Tonnessen Dec. 1969 25 p refs In NORWEGIAN; ENGLISH summary Sponsored by Roy. Norweg. Council for Sci. and Ind. Res.

(TN-7) Avail: NTIS

The development of tool wear in rough turning processes is discussed. Experiments show that the most frequently used criteria for edge durability, free surface wear, and crater wear have little general value. In the development of cutting data the maximum value of the selected criterion should depend on the working conditions. Author (ESRO)

N71-20945# Norges Tekniske Hoegskole, Trondheim. Elektronikklaboratoriet.

INFRARED MEASUREMENT OF SURFACE WEAR ON LATHE TOOLS [INFRAROED MAELING AV SLITASJE PAE DREIESTAEL]

S. Iversen Oct. 1969 62 p refs In NORWEGIAN; ENGLISH summary Sponsored by Roy. Norweg. Council for Sci. and Ind. Res.

(ELAB-TL-132) Avail: NTIS

An attempt has been made to find out whether it is possible to measure the free surface wear on lathe tools through the reflected effects of electromagnetic wave irradiation. Theoretically, the optimum wavelength was shown to be approximately 35 microns. A carbon dioxide laser was used which generates waves of gamma = 10.6 microns. The measurements show that the method is useful. To achieve a satisfactory degree of accuracy, the irradiation area must have a wavelength closer to optimum. ESRO

N71-21003# Danish Research Centre for Applied Electronics, Copenhagen.

LUBRICANTS FOR ELECTRIC CONTACTS: AN INVESTIGATION OF LUBRICATION, CORROSION, AND CONTACT PROPERTIES OF 28 DIFFERENT LUBRICANTS [SMOEREMIDLER TIL ELEKTRISKE KONTAKTER. EN UNDERSOEGELSE AF SMOERE-, KORROSIONS- OG KONTAKTEGENSKABER FOR 28 FORSKELLIGE SMOEREMIDLER]

S. T. Olesen Sep. 1969 73 p In DANISH; ENGLISH summary

(ECR-08) Avail: NTIS

The survey includes lubricants for application in low power contacts, switches, potentiometers, and certain types of connectors. It does not particularly apply to the special problems encountered in low power relay contacts and in power contacts, although some of the results may apply also to these types of contacts. The investigation consists of a number of different types of analyses,

climatic exposures, and electrical measurements, all designed to reveal the capability of reliable performance of the lubricants with respect to assurance of the good contact and low wear through long periods of operation, and at the same time with no deteriorating effects on other materials or components in the equipment. The measurements have shown that only few of the lubricants are suitable in every respect, obviously the manufacturers have had to compromise between different operating requirements. Therefore the user often will have to evaluate which specific operational requirements and environments the contact is exposed to and choose the lubricant accordingly. A few of the lubricants, though, seem to be of sufficient quality to be recommended for normal all round use. Author (ESRO)

N71-21004# Louvain Univ. (Belgium). Inst. of Mechanical Manufacturing.
DISPLACEMENT MEASUREMENTS ON NUMERICALLY CONTROLLED MACHINE TOOLS [LA MESURE DES DEPLACEMENTS SUR LES MACHINES-OUTILS A COMMANDE NUMERIQUE]
Jean Plas (Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal.) and Jan Blommaert (Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal.) Brussels Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal. May 1970 71 p refs In FRENCH Sponsored by IRSIA
(CRIF-MC-31) Avail: NTIS

Operating modes of numerically controlled machine-tools are reviewed. Different types of transducers for position control are discussed and the accuracy of positioning devices is evaluated. ESRO

N71-21060* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FAST OPENING DIAPHRAGM Patent
Goetz K. Oertel and Roger D. Bengtson, inventors (to NASA) Issued 2 Jan. 1968 (Filed 24 Aug. 1965) 4 p Cl. 95-53
(NASA-Case-XLA-03660; US-Patent-3,361,045;
US-Patent-Appl-SN-482307) Avail: US Patent Office CSCL 13G

A fast opening, large aperture diaphragm is described which is opened by the sudden application of a large magnetic field. An electrically conductive thin diaphragm is located in the path of a camera or flowing gas. A coil which surrounds the path is located close to the diaphragm with an insulator between them. The coil is connected in series to a spark gap switch and a bank of generator-charged capacitors. A trigger pulse fires the spark gap switch releasing a current surge through the coil which creates a magnetic field and magnetic pressure which ruptures the disphragm. Schematics of the electrical circuitry and the diaphragm used as an optical shutter and in expansion tubes are included. J.M.

N71-21076* North American Aviation, Inc., El Segundo, Calif.
LATCHING MECHANISM Patent
Earl V. Holman, inventor (to NASA) Issued 12 Oct. 1967 (Filed 4 Mar. 1966) 7 p Cl. 24-263 Sponsored by NASA
(NASA-Case-XMS-03745; US-Patent-3,346,929;
Us-Patent-Appl-XN-534295) Avail: US Patent Office CSCL 13E

A latching mechanism is described which can be operated in a limited access area and which is securely locked by movement of an operating handle in a single direction, and fully disengaged by movement of the handle in an opposite direction. The mechanism has an easily releasable latch which holds the mechanism in a full-open position when it is moved to open position. Official Gazette of the U.S. Patent Office

N71-21078* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLDERING WITH SOLDER FLUX WHICH LEAVES CORROSION RESISTANT COATING Patent
Albert J. Bauman, inventor (to NASA) Issued 12 Dec. 1967 (Filed 21 May 1965) 2 p Cl. 29-495 Sponsored by NASA
(NASA-Case-XNP-03459; US-Patent-3,357,093;
US-Patent-Appl-SN-457879) Avail: US Patent Office CSCL 13H

The method of soldering a metal in the presence of an effective fluxing amount of hydrazine monoperfluoro alkanoate, to leave a soldered area container corrosion resistant inert polymeric coating is described. It was found that the polymer coating provided by the fluxes tenaciously adheres to the soldered surface. In addition, the polymeric material was found to be resistant to the effect of strong chemicals, acids, and the like. While not bound by any theory it is believed that the polymeric material present is generally in the form of an oriented monolayer of a fluorocarbon polymer. Official Gazette of the U.S. Patent Office

N71-21136# Polytechnic Inst. of Cluj, Rumania.
TRANSIENT MOTIONS OF A STRAIGHT SHAFT WITH NON-CIRCULAR CROSS-SECTIONS [MOUVEMENTS TRANSITOIRES DES ARBRES DROITS A SECTION NON CIRCULAIRE]
Andre Ripianu *In* Ecole Natl. Super. de Mecan. Ann. of Mech. Semiann. Rept., 1969 p 49-73 refs In FRENCH (See N71-21133 10-32)
Avail: NTIS

Transient motions of an axisymmetric shaft with noncircular cross-section whose mass is assumed to be concentrated in its center are analyzed taking external friction forces into account. ESRO

N71-21146# Ecole Nationale Superieure de Mecanique, Nantes (France).
DRILLING OF LIGHT ALLOYS (AS7G-AS19G) [CONTRIBUTION AU PERCAGE DES ALLIAGES LEGERS (AS7G-AS19G)]
J. C. Friloux and F. Le Maitre *In its* Ann. of Mech. Semiann. Rept., 1969 p 343-352 In FRENCH (See N71-21133 10-32)
Avail: NTIS

Two types of bits used for drilling aluminum alloys are compared. The surface finishing of the holes drilled and their metallization are evaluated for the two types of drilling bits and for two types of lubricant. ESRO

N71-21176# Denver Univ., Colo. Dept. of Chemical Engineering.
COOLING OF A POLYMER FILAMENT DURING MELT SPINNING
W. H. Wanger and V. G. Fox [1970] 27 p refs
Avail: NTIS

Temperature and diameter were experimentally determined as a function of distance from the spinneret nozzle for melt spun polypropylene monofilaments. Temperature was measured by means of an infrared pyrometer. A mathematical model of the cooling process was developed which made provisions for the heat of fusion, and variable physical properties diameter, and velocity. The surface boundary condition took into account both radiation and convection. The standard deviation of the model from the data was 6% and the maximum deviation was 22%. Author

N71-21177* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STIRRING APPARATUS FOR PLURAL TEST TUBES Patent
Ira J. Strong and Henry A. Leon, inventors (to NASA) Issued 17 Oct. 1967 (Filed 22 Mar. 1966) 5 p Cl. 259-71
(NASA-Case-XAC-06956; US-Patent-3,347,531;
US-Patent-Appl-SN-538166) Avail: US Patent Office CSCL 14B

A device for simultaneously agitating and thermally controlling

the contents of several test tubes is described. Rows of test tubes are supported on a rack in a temperature controlled bath. A rod is suspended in each tube from one of two frames. The frames and rods are oscillated at variable speeds, and in opposite directions to minimize vibration. The stirring rods are adjustable with respect to tube penetration and may be removed from the frames individually or by the row.

Official Gazette of the U.S. Patent Office

N71-21178 National Lending Library for Science and Technology, Boston Spa (England).

PHYSICAL AND METALLURGICAL ASPECTS OF WELDING [LES ASPECTS PHYSIQUES ET METALLURGIQUES DU SOUDAGE]

J. Cabelka 21 Aug. 1970 13 p Transl. into ENGLISH from Soudage Tech. Connexes (France), v. 23, no. 11/12, 1969 p 453–467 In ENGLISH and FRENCH Presented at 1969 Portevin Lecture of the Intern. Kyoto Welding Inst.

(NLL-TRANS-746-532-(9022.401); NLL-LTI-737-6907) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

The physical and metallurgical aspects of welding steel structures are discussed. By new methods of production it is possible to totally eliminate impurities and it is shown that the quality of the steel grains does not depend only on the crystallization nuclei and the supercooling temperature but, for a steel of a given composition, on its purity. The purity of the steel increases the cohesion of the crystals and reduces the number of dislocations which also have a considerable effect on the increase of mechanical properties. Author

N71-21179* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

RANDOM FUNCTION TRACER Patent

Paul F. Fuhrmeister and Milner H. Eskew, Jr., inventors (to NASA) Issued 10 Oct. 1967 (Filed 15 Jul. 1964) 4 p Cl. 235-61.6

(NASA-Case-XLA-01401; US-Patent-3,346,724; US-Patent-Appl-SN-382976) Avail: US Patent Office CSCL 13I

A device for obtaining the Cartesian coordinates of points on a contour map in digital form is described. The device is a random function tracer which uses a fast and simple digitizing and recording system and a computer. The tracing device is similar to a standard drafting machine. A series of potentiometers, which are actuated by the movement of the tracing devices are used to feed electrical signals to the digitizing and recording system. The recording system converts the voltages to the digital form and records them. The recordings are then applied to a computer which converts the recordings to Cartesian coordinates.

Official Gazette of the U.S. Patent Office

N71-21221# Honeywell, Inc., Hopkins, Minn. Corporate Research Center.

EFFECTS OF SURFACE FINISHING ON MECHANICAL AND OTHER PHYSICAL PROPERTIES OF CERAMICS

Robert J. Stokes Dec. 1970 39 p refs

(Contract N00014-69-C-0123)

(AD-716886; TR-3) Avail: NTIS CSCL 13/8

The report reviews the effects of mechanical finishing operations on the physical properties of ceramics. Ceramic machining results in a defective surface containing cracks, dislocations, point defects and residual stresses. The relative significance of these defects depends on the physical property of interest. The mechanical properties of single crystals are sensitive to dislocations (semi-brittle) and surface cracks (brittle); the mechanical properties of polycrystals are sensitive to surface cracks; the electrical properties of semiconductors are sensitive to surface trapping sites; magnetic, piezoelectric and optical properties are particularly sensitive to residual stresses. To optimize physical properties these defects must be eliminated by mechanical lapping, chemical etching or thermal annealing. Author (GRA)

N71-21234* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

VALVE SEAT WITH RESILIENT SUPPORT MEMBER Patent

Elvis D. Wallace, inventor (to NASA) Issued 27 Jun. 1967 (Filed 7 Jan. 1965) 4 p Cl. 251-172

(NASA-Case-XKS-02582; US-Patent-3,327,991; US-Patent-Appl-SN-424153) Avail: US Patent Office CSCL 13K

A valve seating arrangement is described which is useful in venting valves where high unit pressures are found, such as in launch support operations of rocket vehicles. The valve is constructed partly of a body of relatively soft material combined with an insert ring of a hard, wear resistant material. The body of soft material is fabricated from two separate rings fitted closely into a recess in the body of the valve. One ring acts as a resilient spring member supporting the hard insert and a sealing ring. The latter ring and the insert have faces machined to form a sealing abutment surface upon which the poppet can be seated.

Official Gazette of the U.S. Patent Office

N71-21290# California Univ., Berkeley. Lawrence Radiation Lab.

TRANSFER PROCESSES IN ECM

D. Landolt, R. H. Muller, and C. W. Tobias Oct. 1970 28 p refs Presented at Symp. on Fundamental Aspects of Electrochem. Machining, Atlantic City, 4–9 Oct. 1970

(Contract W-7405-eng-48)

(UCRL-19615; CONF-701016-2) Avail: NTIS

ECM is viewed as a special case of an electrochemical process conducted at extremely high current densities with narrowly spaced electrodes. Particular problems are clarified, including the dynamic behavior of anodic layers and the transport of dissolved, gaseous, and solid products from the electrodes. Optical observations, potential measurements, and various analytical techniques were employed to elucidate transport mechanisms involved in the dissolution of copper of current densities up to 150 A/sq cm. Author

N71-21311* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

HOLDER FOR CRYSTAL RESONATORS Patent

Kenneth H. Le Vay, inventor (to NASA) Issued 19 Dec. 1967 (Filed 4 May 1965) 4 p Cl.310-9.1 Sponsored by NASA

(NASA-Case-XNP-03637; US-Patent-3,359,435; US-Patent-Appl-SN-453232) Avail: US Patent Office CSCL 13I

A holder for a high frequency crystal defining a main support cavity, in which the crystal is supported under pressure is described. A pair of vibration cavities extend from the support cavity on opposite sides to provide free space into which the crystal can vibrate. Conductive layers on opposite sides of the support cavity and connected leads provide means by which the crystal may be connected to external circuits.

Official Gazette of the U.S. Patent Office

N71-21312 Purdue Univ., Lafayette, Ind.

FLOW, COMPACTION AND FRICTIONAL LOSSES UNDER A DRIVEN WHEEL ON SOFT SOIL

Louis Izaak Leviticus (Ph.D. Thesis) 1969 191 p

Avail: Univ. Microfilms: HC $8.80/Microfilm $3.00 Order No. 70-3926

The problem of traction and the existing theories and methods to predict vehicle performance on a soft soil, were reviewed with the following results: (1) So far no reliable mathematical models to express soil behavior under a wheel were developed. This is primarily due to the three dimensional, dynamic and transient character of the phenomena, as well as the complexity of the

medium. (2) The parameters describing the soil properties are of great importance, but are not unique. They are dependent upon the method of measurement and their effectiveness should be judged by their consistency and proper use in the proper equations. (3) The use of force or energy as output variables is not satisfactory since the forward velocity of the vehicle is also an output variable and its exclusion from the analysis will destroy similarity between the actual occurrence and the theory. Dissert. Abstr.

N71-21321 National Lending Library for Science and Technology, Boston Spa (England).

EFFECT OF GEOMETRIC TOOL PARAMETERS AND CUTTING CONDITIONS ON THE FORCES, TEMPERATURE, AND RESIDUAL STRESSES IN THE SURFACE LAYER DURING THE TURNING OF PLASTICS [ULIYANIE GEOMETRICHESKIKH PARAMETROU INSTRUMENTA I REZHIMA REZANIYA NA SILY, TEMPERATURU I OSTATOCHNYE NAPRYAZHENIYA V POVERKHNOSTVOM SLOE TOCHENII PLASTMASS]

L. E. Batrin Aug. 1970 15 p refs Transl. into ENGLISH from Vysokoproizvoditel'nose Rezanie v Mashinostroenii (Moscow), 1966 p 289–292

(NLL-RTS-5815) Avail: Natl. Lending Library, Boston Spa, Engl.: 30s, 5 NLL photocopy coupons

Problems in the measurement of forces, temperatures, residual stresses, and surface quality of plastics during machining are outlined. A description is given of the equipment used including a dynamometer with strain gage, signal amplifier, and recording oscillograph for cutting force measurement; compound cutters with oscilloscope recording of thermo-electromotive force; and a double microscope for surface finish measurement. Equations for calculating cutting forces including friction and rake angle coefficients are presented. Rake angle, cutting speed and feed effects on temperature; cutting force and surface finish dependence on depth of cut, feed, and rake angle; relief angle effect on cutting force; and curves of residual tangential stresses are shown graphically for polystyrene and Teflon. J.M.

N71-21352*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

ADVANCED PROJECTS DEVELOPMENT

In its Space Programs Sum. No. 37-66, Vol. 3, Oct.–Nov. 1970 31 Dec. 1970 p 148–159 refs (See N71-21338 10-30)

Copyright. Avail: NTIS CSCL 13I

A torsion rod actuator and concentric rotating tube viscous damper are developed for deployment of the Thermoelectric Outer Planet Spacecraft (TOPS) radioisotope thermoelectric generator (RTG) and science booms. A test model has been constructed and used to verify the deployment characteristics predicted by an analog computer program. Also reported are design and manufacturing of the TOPS high gain radial rib antenna having a deployable main reflector. G.G.

N71-21364# Bendix Corp., Kansas City, Mo.

TRANSFER MOLDING CLOSE TOLERANCE PARTS

R. J. Hishan Nov. 1970 18 p

(Contract AT(29-1)-613)

(BDX-613-166) Avail: NTIS

Visual defects related to transfer-molded parts of epoxy and diallyl phthalate compounds are discussed. Sequential photographs taken from high speed motion pictures made of the flow patterns which occurred in a variety of cavity configurations are presented. The films and direct observation were made possible by a special fused quartz lens, or viewing window, installed in the wall of the mold. The monitored flow characteristics provide the bases for the conclusions. Author

N71-21365# California Univ., Berkeley. Lawrence Radiation Lab.

PERIODIC PHENOMENA IN COPPER DISSOLUTION AT CONSTANT CURRENT

J. Cooper, R. H. Muller, and C. W. Tobias Oct. 1970 17 p refs Presented at Symp. on Fundamental Aspects of Electrochem. Machining, Atlantic City, 4–9 Oct. 1970

(Contract W-7405-eng-48)

(UCRL-19618; CONF-701016-1) Avail: NTIS

Anode potential fluctuations have been observed in high rate galvanostatic dissolution of copper in different electrolytes. The fluctuations are most pronounced and periodic in chlorate solutions. Variations in apparent valence of the dissolution process, in the products formed and in the surface temperature, have been determined in the course of one cycle. While a complete description of the mechanism of dissolution is not, as yet, possible, a theoretical model has been developed which accounts for the observed phenomena. Author

N71-21403* Midwest Research Inst., Kansas City, Mo.

INORGANIC SOLID FILM LUBRICANTS Patent

Donald H. Gaddis and Vernice Hopkins, inventors (to NASA) Issued 2 Jan. 1968 (Filed 9 Sep. 1966) 2 p Cl. 252-26 Sponsored by NASA

(NASA-Case-XMF-03988; US-Patent-3,361,666; US-Patent-Appl-SN-578923) Avail: US Patent Office CSCL 11H

The preparation of inorganic solid film lubricants having the following composition in weight percent of total dry solids: molybdenum disulfide, 34 to 50; graphite, 4 to 5; aluminum phosphate, 15 to 20; and either gold, 20 to 25; or bismuth, 40 to 47 is described. The aluminum phosphate serves as binder and the remaining components are finely divided lubricating solids dispersed in the binder. These lubricants exhibit stability under space environmental conditions and a long wear life. Official Gazette of the U.S. Patent Office

N71-21404* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

METHOD AND APPARATUS FOR BONDING A PLASTICS SLEEVE ONTO A METALLIC BODY Patent

Charles B. King, inventor (to NASA) Issued 5 Dec. 1967 (Filed 31 Jul. 1964) 10 p Cl. 156-3

(NASA-Case-XLA-01262; US-Patent-3,356,549; US-Patent-Appl-SN-386800) Avail: US Patent Office CSCL 13H

A bonding procedure is described for attaching a polytetrafluoroethylene thermal protective sleeve to a truncated conical magnesium alloy structural shell component. A uniform adhesive bond line gap is maintained between the sleeve and body along the entire sleeve length. Official Gazette of the U.S. Patent Office

N71-21434*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INVESTIGATION OF ISOTHERMAL COMPRESSIBLE FLOW ACROSS A ROTATING SEALING DAM. 2: COMPUTER PROGRAM

John Zuk, Patricia J. Smith, and Lawrence P. Ludwig Washington Sep. 1970 49 p refs

(NASA-TN-D-5345; E-5109) Avail: NTIS CSCL 11A

A computer program is presented for the analysis of compressible fluid flow across a sealing dam, such as is used in a shaft seal. The mathematical model consists of two closely spaced parallel rings, one of which is rotating. The analysis is restricted to steady, laminar, subsonic, isothermal flow. The effect of rotation on mass flow, pressure distribution, and other physical parameters is determined. The computer program is written in FORTRAN IV. The input and output variables are in English units;

printout of data in the International System of units is optional.
Author

N71-21444# National Bureau of Standards Boulder, Colo. Cryogenics Div.
PERFORMANCE OF LIQUID NITROGEN PUMP IN NBS FLOW RESEARCH FACILITY
J. A. Brennan, J. W. Dean, D. B. Mann, and C. H. Kneebone 1 Feb. 1971 20 p refs
(NBS-9777) Avail: NTIS

Performance of the liquid nitrogen circulating pump in the National Bureau of Standards cryogenic flow research facility is discussed. Pump operational problems and solutions to these problems are presented along with pump performance curves.
Author

N71-21489* Douglas Aircraft Co., Inc., Santa Monica, Calif.
SPLIT NUT SEPARATION SYSTEM Patent
William F. Carr, inventor (to NASA) Issued 14 Nov. 1967 (Filed 26 Oct. 1966) 4 p Cl. 85-33 Sponsored by NASA Prepared for JPL
(NASA-Case-XNP-06914; US-Patent-3,352,192;
US-Patent-Appl-SN-590147) Avail: US Patent Office CSCL 13E

A device is described for releasably securing adjoining sections of objects to each other with provision for automatic separation. The device comprises a nut and bolt separation system. E.C.

N71-21528* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CANISTER CLOSING DEVICE Patent
Austin D. McHatton, Joseph V. Boyle, Jr., and Wilbert C. Falk, inventors (to NASA) Issued 22 Aug. 1967 (Filed 30 Sep. 1964) 5 p Cl. 53-102
(NASA-Case-XLA-01446; US-Patent-3,336,725;
US-Patent-Appl-SN-400613) Avail: US Patent Office CSCL 13I

A remotely controlled mechanism for closing a container within a vacuum chamber is described. The present invention overcomes the difficulties inherent in the prior art by providing a remotely controlled mechanism in a vacuum chamber sufficiently large to contain the canister and article to be enclosed. A remotely controlled source of power acts on a drive mechanism and leverage system to effect closing of the canister within the vacuum environment. Official Gazette of the U.S. Patent Office

N71-21529* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NONMAGNETIC, EXPLOSIVE ACTUATED INDEXING DEVICE Patent
John P. Bauernschub, Jr., inventor (to NASA) Issued 18 Jul. 1967 (Filed 7 Oct. 1965) 11 p Cl. 74-126
(NASA-Case-XGS-02422; US-Patent-3,331,255;
US-Patent-Appl-SN-493943) Avail: US Patent Office CSCL 13I

An indexing device with positionable means having at least first and second stable positions, a ratchet arm, a ratchet coupled to the positionable means and engageable with the ratchet for retaining the positionable means in one stable position, and explosive means for actuating the ratchet arm to momentarily release the ratchet and permit the positionable means to assume another stable position is described. Official Gazette of the U.S. Patent Office

N71-21530* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SHOCK ABSORBER Patent
William K. Creasy and James C. Jones, inventors (to NASA) Issued 11 Jul. 1967 (Filed 16 Sep. 1965) 6 p Cl. 267-64
(NASA-Case-XMS-03722; US-Patent-3,330,549;
US-Patent-Appl-SN-487934) Avail: US Patent Office CSCL 13G

A double-acting shock absorber that can function highly efficiently over a large range of impact loads is described. Docking mechanisms of the type used in mating two vehicles together while both are in flight must include some means to dissipate kinetic energy when the vehicles contact each other. The amount of energy to be dissipated will depend upon both the mass of each vehicle and the relative closing speed between them at the time of impact. Since some spaceflight mission plans call for multiple docking operations during the same flight, the energy attenuating or shock absorbing means for the docking mechanism used in such flights must be capable of handling impacts over a wide range of energy values. Official Gazette of the U.S. Patent Office

N71-21531* Spectrolab., Inc., Sylmar, Calif.
CENTRAL SPAR AND MODULE JOINT Patent
Michael Dubey and Ronald M. Diamond, inventors (to NASA) Issued 11 Jul. 1967 (Filed 11 Feb. 1965) 5 p Cl. 52-127 Sponsored by NASA
(NASA-Case-XNP-02341; US-Patent-3,330,082;
US-Patent-Appl-SN-432025) Avail: US Patent Office CSCL 13E

A module joint arrangement for attaching together, (1) a hollow central member having a longitudinal axis, and (2) two members extending outwardly from said central member, is discussed. The extending members contain straps that pass through openings in the surface of the central member, and that extend into its interior. Clamp means is carried within the central member and engages the straps to clamp them transversely together within the central member. The clamp means includes a base section and wedge section that are movable transversely relative to the axis of the central member to clamp onto the straps, and form a secure joint. Official Gazette of the U.S. Patent Office

N71-21536* North American Aviation, Inc., El Segundo, Calif.
TUBE DIMPLING TOOL Patent
Charles S. Beuyukian and Robert M. Heisman, inventors (to NASA) Issued 10 Oct. 1967 (Filed 27 Dec. 1966) 5 p Cl. 72-34 Sponsored by NASA
(NASA-Case-XMS-06876; US-Patent-3,345,840;
US-Patent-Appl-SN-605100) Avail: US Patent Office CSCL 13I

A hand tool for forming dimples and nipples on the end portion of tubes is described for centering tubes of different diameters, preparatory to brazing for joining. The tool is a plier-like device with one jaw being a mandrel adapted to receive a tube in sleeved position. A projection on the mandrel forms a dimple on the inner surface of the tube, and a nipple on the outer surface when the jaws are closed. F.O.S.

N71-21666*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FATIGUE LIVES AT 600 F OF 120 MILLIMETER BORE BALL BEARINGS OF AISI M-50, AISI M-1, AND WB-49 STEELS
Eric N. Bamberger (GE, Evansdale, Ohio) and Erwin V. Zaretsky Washington Mar. 1971 29 p refs
(NASA-TN-D-6156; E-6004) Avail: NTIS CSCL 13I

Groups of 120 mm bore angular-contact ball bearings made from consumable-electrode vacuum melted AISI M-50, AISI M-1, and WB-49 steels were fatigue tested with a synthetic parafinic oil in a low oxygen environment at a bearing outer-race temperature of 600 F (588 K). The experimental lives of the bearings made from the AISI M-50 and AISI M-1 steels exceeded the AFBMA predicted (catalog) life by factors in excess of 13 and 6, respectively. The experimental life of the WB-49 bearings was less than half the AFBMA predicted (catalog) life. An apparent correlation exists between the rolling-element fatigue predicted life of carbides

(incidence, size, shape, and location) and the type of alloying element. For all three materials tested, the mode of failure was classical subsurface initiated rolling-element fatigue. Author

N71-21667*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BOUNDARY LUBRICATION AND THERMAL STABILITY STUDIES WITH FIVE LIQUID LUBRICANTS IN NITROGEN TO 400 C
William R. Jones, Jr. and William F. Hady Washington Mar. 1971 18 p refs
(NASA-TN-D-6251; E-5841) Avail: NTIS CSCL 11H

A pin-on-disk friction apparatus was used to determine friction and wear of steel in nitrogen with five lubricants. Good boundary lubrication was obtained from 200 to 400 C with a glycol derivative and with a synthetic paraffinic oil containing an antiwear additive. Equally good results were obtained from 200 to 320 C with an advanced ester. A paraffinic resin and a synthetic paraffinic oil without an additive were effective boundary lubricants at some temperatures but not over the entire temperature range. Maximum useful lives calculated from thermal stability data were usually in the order of paraffinic resin > synthetic paraffinic oil > flycol >> advanced ester at temperatures from 200 to 350 C. Author

N71-21744* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BIDIRECTIONAL STEP TORQUE FILTER WITH ZERO BACKLASH CHARACTERISTIC Patent
Leo J. Veillette, Seth R. Williams, and Ralph L. Baker, inventors (to NASA) Issued 26 Dec. 1967 (Filed 25 Apr. 1966) 3 p Cl. 74-409
(NASA-Case-XGS-04227; US-Patent-3,359,819; US-Patent-Appl-SN-545805) Avail: US Patent Office CSCL 13I

The apparatus comprises a gearing system including an input shaft and an output shaft, driving means fixed to the input shaft, and a pair of driven gears mounted freely for rotation on the output shaft. The system is interconnected through elastomeric elements to a flange fixed on the output shaft in such a manner that variations in input torque are absorbed to provide a smooth torque on the output shaft.
Official Gazette of the U.S. Patent Office

N71-21786# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
FRICTION AND CREEP IN ROLLING CONTACT
P. R. Nayak, S. Hariharan, Raya Stern, R. Abilock, P. A. March et al Nov. 1970 273 p refs Sponsored by DOT
(PB-196707; FRA-RT-71-64) Avail: NTIS CSCL 13F

Factors examined for their influence on friction (adhesion) and creep are surface roughness, surface vibration, surface contamination, dynamic loading due to irregular track, and rolling velocity. The following conclusions are reached: surface roughness does not influence the creep coefficients at operating loads. However, surface roughness influences the tractive capacity when the wheel and rail surfaces are either very clean or flooded with a contaminant, surface vibrations affect wheel-rail friction considerably, surface contamination decreases both friction and creep coefficients. The magnitude of the change in these coefficients depends on the oil viscosity temperature and pressure coefficients, the normal load on the wheel and the surface roughness, dynamic loads due to suspension resonances do not appear to influence the friction or creep coefficients significantly. GRA

N71-21811# Southern Research Inst., Birmingham, Ala.
A MANUAL OF ELECTROSTATIC PRECIPITATOR TECHNOLOGY. PART 1: FUNDAMENTALS
Sabert Oglesby, Jr. and Grady B. Nichols 25 Aug. 1970 338 p refs
(Contract PHS-CPA-22-69-73)
(PB-196380; APTD-0610) Avail: NTIS HC $6.00/MF $0.95 CSCL 13B

The report is intended to serve as a basic handbook on the subject of electrostatic precipitation covering the entire system including fundamental theory, design, operation, and application. This manual is organized to present a general review of the precipitation process, with qualitative relationships between the various precipitator functions and a detailed quantitative analysis of each of the system functions. Particular emphasis is placed on the validity of the theoretical derivations in view of the assumptions made and the significance of the interaction of variables of importance in precipitator operation. Further discussions include mechanical design considerations, energization equipment, gas flow, operational problems, and the current utilization of precipitators in the major application areas. Author (GRA)

N71-21812# Southern Research Inst., Birmingham, Ala.
A MANUAL OF ELECTROSTATIC PRECIPITATOR TECHNOLOGY. PART 2: APPLICATION AREAS
Sabert Oglesby, Jr. and Grady B. Nichols 25 Aug. 1970 584 p refs
(Contract PHS-CPA-22-69-73)
(PB-196381; APTD-0611) Avail: NTIS HC $6.00/MF $0.95 CSCL 13B

The report presents information based on records covering electrostatic precipitator installations in the various application areas. To supplement this data a number of installations in various industries were surveyed. In some instances, considerable data were available covering both design and performance of the precipitators. In other instances, data were not available. Consequently, the extent and quality of the information covering the application areas varies. Chapters are included on: electric power generation; pulp and paper; iron and steel industry; rock products; chemical industry; municipal incinerators; petroleum industry; non-ferrous metals; high temperature, high pressure gas cleaning; and new application areas. GRA

N71-21813# Southern Research Inst., Birmingham, Ala.
SELECTED BIBLIOGRAPHY OF ELECTROSTATIC PRECIPITATOR LITERATURE
Mar. 1970 161 p refs
(Contract PHS-CPA-22-69-73)
(PB-196379; APTD-0612) Avail: NTIS CSCL 13B

The bibliography is arranged alphabetically by author and numbered sequentially. In the back of the bibliography, about 100 descriptors comprising the thesaurus are listed with numbers corresponding to the articles for which the particular descriptor is appropriate. Author (GRA)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N71-20663# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.
LIGHTSCATTERING IN GASES [LASERLICHTSTREUUNG IN GASEN]
Gustav Schweiger and Guenter Requardt Oct. 1970 49 p refs In GERMAN; ENGLISH summary
(DLR-FB-70-53) Avail: NTIS; ZLDI Munich: 13.30 DM

The theoretical analyses of Rayleigh, Rayleigh-Gans, and Thomson scattering as a basis for gas diagnostics are given. Due

to the depolarization of scattered light, the measurement of density and the degree of ionization seems to be possible as long as the ionization is not less than 0.1%. The experimental apparatus for the density measurements is described. Author (ESRO)

N71-20983# Naval Ordnance Lab. White Oak, Md.
VIBRATIONAL POPULATION INVERSIONS WITHIN NORMAL SHOCK WAVES IN CO2-N2-He MIXTURES Final Report
John D. Anderson, Jr., Michael T. Madden, and Carolyn H. Piper 7 Oct. 1970 44 p refs
(AD-716743; NOLTR-70-214) Avail: NTIS CSCL 20/5

Numerical solutions are given for vibrational population inversions created in CO2-N2-He mixtures due to shock wave heating of a cold gas. The results indicate that population inversions between the (040) and (001) energy levels of CO2 and, to a lesser degree, between the (200) and (001) levels, can be created in the vibrational nonequilibrium flow behind a normal shock front. The properties of these inversions as a possible laser medium are assessed; the results indicate that the laser properties of this shock-induced nonequilibrium flow are not as promising as those of lasers operating on the principle of rapid expansions. Author (GRA)

N71-20912# Army Electronics Command, Fort Monmouth, N.J.
SMALL SIGNAL SERIES MULTITRANSVERSE PREDETECTION QUANTUM AMPLIFIER
Charles J. Bickart, Hans Hieslmair, and John N. Fulton Nov. 1970 17 p refs
(AD-716991; ECOM-3355) Avail: NTIS CSCL 20/5

The report describes the design and experimental results observed with a 10.6 micrometer multitraverse 137.5 cm predetection quantum amplifier as a single stage amplifier, and a part of a two-stage amplification scheme. Operating as a single amplifier, an electronic gain of > 30 dB has been measured as the second stage of a two-stage series combination, an additional gain of 10 dB is possible over the original 39 dB gain of the 83.5 cm first stage. Sealed-off design features are discussed. Author (GRA)

N71-20927 California Univ., Berkeley.
LOW ENERGY ELECTRON DIFFRACTION STUDY OF RADIATION, OXIDATION, AND DIFFUSION ON SOLID SURFACES
Salah Mohamed Ali Bedair (Ph.D. Thesis) 1969 88 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-18880

The high power Q-spoiled laser was combined with low energy electron diffraction measurement of the resultant surface structure to produce an atomically clean surface under vacuum. However, complete removal of oxygen and carbon contamination from nickle surfaces by laser bombardment at 100 MW/sq cm produced irreparable surface damage that is attributed to filamentization of the laser beam or to nonuniform surface reflectivity. Application of the technique at 30 MW/sq cm successfully removed the (7×7) satellite structure from the (111) silicon surface. Annealing, reduced the surface defects and resulted in the reappearance of the silicon (7×7) structure with an activation energy of 1.1 ev/atom for migration. Similarly, the activation energy for disorder-order transition of one third monolayer of aluminum on silicon (111) surface was found to be 0.9 ev/atom. Aluminum was deposited on the silicon surface under vacuum using the laser. The structure of oxygen on aluminum (100), (111), and (110) surface was also studied. Dissert. Abstr.

N71-21278 California Univ., Berkeley.
INTERACTION OF HIGH INTENSITY LASER RADIATION WITH METALLIC SURFACES
Giulio Varsi (Ph.D. Thesis) 1969 150 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 70-6251

Relevant aspects of the interaction between focused, pulsed laser radiation and copper or gold targets have been investigated experimentally; a phenomenological model of process has been proposed and its validity has been shown for values of the radiation density ranging over approximately two decades. A complete literature review of over 100 papers, published between 1962 and 1968, is presented to introduce the subject of the investigation and to examine critically the experimental information reported and the models proposed by the students of the subject. A novel experiment is reported for the accurate determination of the yield: the amount of material ablated by the laser radiation. A radioactive tracer technique has been employed for the measurement of the yield as a function of energy content and duration of the laser pulse. Dissert. Abstr.

N71-21290# University of Southern Calif., Los Angeles.
APPLICATIONS OF HOLOGRAPHY TO VIBRATIONS OF AN AXISYMMETRIC IMPERFECT CONICAL SHELL
T. Furuike and V. I. Weingarten [1971] 14 p refs Sponsored by NSF Prepared in cooperation with North American Rockwell Corp., Downey, Calif.
Avail: Issuing Activity

An experimental and analytical investigation to determine the effects of an axisymmetric imperfection on the free vibrations of conical shells is presented. The time-average holographic interferometry technique is applied to the study of transverse vibrational modes. The images formed during the reconstruction process illustrate the use of this powerful method in identifying the various vibration modes of conical shells with and without an axisymmetric imperfection. Photographs of the images are presented to illustrate the modal shapes of the conical shells at natural frequencies and the presence of a complex modal coupling pattern. The finite element method with a higher order Hermitian polynomial displacement field is used to analytically obtain the vibrational characteristics of clamped conical shells with an initial axisymmetric imperfection. The axisymmetric imperfection is described by using many conical elements that region. A helium-neon continuous wave laser is used as the source of coherent light. Author

N71-21320*# TRW Systems Group, Redondo Beach, Calif.
EXPERIMENTAL ASPECTS OF HOLOGRAPHIC INTERFEROMETRY
Ralph F. Wuerker [1969] 13 p refs Submitted for publication (Contract NAS2-4992)
(NASA-CR-114291) Avail: NTIS CSCL 20E

Industrial applications of holography and holographic interferometry are discussed including the recording of high speed elusive phenomena, aerodynamic visualization, nondestructive testing, and contouring. Optical systems insensitive to the incoherence of laser illuminators are cited. Holography with Q-switched ruby lasers are emphasized using optical arrangements to compensate for spatial and temporal incoherence of the illuminators. J.M.

N71-21323# Wayne State Univ., Detroit, Mich.
A STUDY OF ENERGY TRANSFER PROCESSES IN MOLECULAR LASERS Quarterly Technical Report, 31 Jul.–31 Oct. 1970
Alexander J. Glass 31 Oct. 1970 17 p refs
(Contract DAHC04-70-C-0022; ARPA Order 675)
(AD-717089; QTR-3) Avail: NTIS CSCL 20/5

Briefly discussed is research concerned with the following topics: Application of currently available close coupling codes to the calculation of cross sections of interest to the molecular lasers under consideration (initially N2, N2O, CO2, and CO); Extension of the existing computer program for the vibrational population

distribution of a binary mixture of gases to include excitation and de-excitation processes specific to the laser mixtures of interest; Application of the spectroscopic observation of side light and small signal gain measurements to the determination of vibrational and rotational population distributions in the molecular laser systems under study (initially CO2 and CO); and Preliminary computer modeling of the laser system, to include the effects of spatial variation of electron density and temperature and gas temperature.
Author (GRA)

N71-21354# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
SPACE SIMULATION
In its Space Programs Sum. No. 37-66, Vol. 3, Oct.–Nov. 1970 31 Dec. 1970 p 171–174 refs (See N71-21338 10-30)
Copyright. Avail: NTIS CSCL 20E

Heat transfer efficiency in xenon arc lamps is studied by double exposure holographic interferometry to determine the conditions in the gas stream between the cathode and the anode. Hologram interpretations show no evidence of gas density variation in the vicinity of the center core and no evidence of a highly localized region of low density gas. A nondescript fringe pattern implies brief stability in the gas flow pattern. Introduction of a magnetic field deflected the arc.
G.G.

N71-21443*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
LASER FREQUENCY STABILIZATION USING A MOLECULAR BEAM Final Report, 1 Feb.–31 Dec. 1969
Shaoul Ezekiel 15 Mar. 1971 16 p refs
(Grant NGR-22-009-359)
(NASA-CR-117528) Avail: NTIS CSCL 20E

The use of an iodine absorption resonance, observed in a molecular beam, as a long-term frequency reference was investigated for the stabilization of a 5145 A argon ion laser. A single-frequency 5145 A laser beam excites the I2 molecular beam at right angles and the absorption is measured by the induced resonance fluorescence of the I2 molecules. This absorption resonance is then used as a frequency reference in a feedback stabilization system. Two sources of short-term instability were considered: The fluctuation in the refractive index of the gain medium attributable, for example, to plasma oscillations and plasma noise in the discharge tube; and the fluctuation in the physical length of the single longitudinal mode cavity comprising two cavities, a long one and a short one coupled together by means of a servo loop.
Author

N71-21479# Stanford Univ., Calif. Microwave Labs.
CONTROL OF TRANSIENT BEHAVIOR OF LASER OSCILLATORS Final Report, 1 Mar. 1968–1 Mar. 1970
R. H. Pantell 1970 77 p refs
(Grant NSF GK-2333)
(ML-1887) Avail: Issuing Activity

The pulse stretching of Q switched Ruby lasers, produced by stimulated Rayleigh wing scattering in an organic fluid, is investigated. Since the Rayleigh frequency is within the gain lineshape of the active medium, threshold for the stimulated Rayleigh scattering is exceeded at relatively low power densities. The laser pulse duration may be increased by an order of magnitude or more by this method. The results are in approximate accord with the computer calculations.
Author

N71-21560# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOLID STATE OPTICAL GENERATORS
A. L. Mirselyan et al 13 Nov. 1970 441 p refs Transl. into ENGLISH of the book "Optich. Generatory Natverdomtele" Moscow, 1967 p 1–384
(AD-716943; FTD-MT-24-178-70) Avail: NTIS HC $6.00/MF $0.95 CSCL 20/5

The report is devoted to solid-state lasers, which are based upon balanced and semi-classical equations and also equations of quantum electrodynamics. Various types of solid-state lasers and amplifiers and dependences of their output characteristics on parameters of an active medium, resonator, pumping and others are examined. Much attention is given to the nonstationary process of generation and amplification. Limiting characteristics of lasers are determined. Results of the most interesting experimental investigations are given. Properties of various crystals and glasses, which are used as active media, are discussed. Spectra of their absorption and radiation, fundamental characteristics of energy levels, probabilities of transitions, and some temperature dependences are examined. Various methods of the excitation of optical generators and pumping systems which provide the effective transmission of exciting radiation into active specimens, are examined. Fundamental questions of the theory of optical resonators are discussed. The structure of their types of oscillations, their resonance frequencies, and quality factor are given. Feasible methods of the selection of types of oscillations in optical generators are considered.
Author (GRA)

N71-21580# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE FREQUENCY CHARACTERISTICS OF A RING GAS LASER
G. B. Gutman et al [1970] 4 p refs Transl. into ENGLISH from Zh. Prikl. Spektroskoppii, Akad. Nauk Belorusski SSR (Minsk), v. 13, no. 4, 1970 p 722–725
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A mathematical expression is developed for the beat signal frequency corresponding to the rotation of a rotating ring laser through a fixed angle. The beat frequency is determined for the generation frequencies at the center of the Doppler contour and a 150 MHz detuning. It is concluded that the magnification of the beat signal frequency during cavity detuning is explained mainly by the nonlinear pulling of the generation frequency to the center of the Doppler contour.
N.E.N.

N71-21674# California Univ., Irvine. Dept. of Engineering.
INVESTIGATION OF SPECTRAL AND STATISTICAL PROPERTIES OF SINGLE-MODE CW LASERS Final Report, 1 Jul. 1969–30 Jun. 1970
Hideya Gamo and Shih-Shung Chuang 31 Jul. 1970 47 p refs
(Contract F19628-69-C-0147)
(AD-716847; AFCRL-70-0468) Avail: NTIS CSCL 20/5

Variance and power spectrum of intensity fluctuations of a single mode CW CO2 10.6 micron gas laser have been measured by using a copper-doped Germanium detector and analog instrumentation. RMS intensity fluctuations above the oscillation threshold was smaller than 0.3% of the average intensity. The measurements near the oscillation threshold, however, were not accurate, because the acoustic disturbance due to acoustical noise, bubbles in the cooling water and temperature fluctuations in the plasma tube were preodiminant over the fluctuations due to spontaneous emission. The power spectrum observed at frequencies above 10KHz showed features characteristic to the laser model of Van der Pol oscillator driven by the random noise. Improvements of CO2 gas laser desirable for further investigation are discussed.
Author (GRA)

N71-21718# Oregon Graduate Center for Study and Research, Portland.
MULTIWAVELENGTH LASER PROPAGATION STUDY, 3 Quarterly Progress Report, 16 Sep.–15 Dec. 1970
J. Richard Kerr Jan. 1971 64 p refs
(Contract N00014-68-A-0461-0001; ARPA Order 306)
(AD-717088; Rept-1154-10; QPR-2) Avail: NTIS CSCL 20/6

An extensive experimental investigation of multiwavelength

laser beam scintillations and atmospheric turbulence characteristics has been completed. It has been found that turbulence spectra approximate the inertial-subrange model only under conditions of strong turbulence, which corresponds with saturation of scintillations at visible and near-IR wavelengths. Hence, it is only at longer wavelengths (such as 10.6 microns) that Rytov analyses utilizing the inertial subrange have substantial value. The saturation phenomenon occurs at the same scintillation levels independent of wavelength, and significant falloff of scintillation beyond saturation is observed. Covariance measurements show transverse amplitude correlation lengths which are significantly affected by strong turbulence; the correlation lengths increase at shorter wavelengths while decreasing at longer wavelengths, as turbulence increases. Receiver aperture-averaging results at visible wavelengths show that the large-aperture smoothing of total-signal fluctuations is much less effective than theoretically predicted, and confirm the especially-poor averaging in strong turbulence conditions. Author (GRA)

N71-21787# Rochester Univ., N.Y.
INTERACTION BETWEEN INTENSE OPTICAL RADIATION AND MATTER Final Report
Michael Hercher and William P. Chu Dec. 1970 188 p refs
(Contract DA-31-124-ARO(D)-401; ARPA Order 675)
(AD-717095; AROD-5995-6-F) Avail: NTIS CSCL 20/5

The report describes a study of the nonlinear absorption properties of a number of the organic dye molecules which have been widely used in conjunction with ruby lasers. The dominant characteristic of this nonlinear behavior is a reduction in the optical transmission of a dye sample when irradiated with intense laser light. The three dye molecules studies are cryptocyanine, metalfree phthalocyanine, and chloroaluminum phthalocyanine, which were dissolved in a variety of solvents. The primary photophysical processes of polyatomic molecules are discussed. Several excited-state lifetime of the three molecules have been determined experimentally. The saturation of molecular absorption for these three molecules is analyzed on the basis of a rate equation approach to a simple three-level model plus excited-state absorptions. The general characteristics of dye Q-switched laser pulse evolution are also discussed and experiments are described which were performed to study the nature of the spectral hole-burning responsible for frequency-locking between different lasers. Also research on photon-induced breakdown of gases due to inverse Bremsstrahlung is very briefly summerized. Author (GRA)

N71-21788# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
THE USE OF CO AND CO2 LASERS TO DETECT POLLUTANTS IN THE ATMOSPHERE
Robert T. Menzies Dec. 1970 32 p refs
(Grant AF-AFOSR-1492-68)
(AD-717171; AFOSR-70-2921TR) Avail: NTIS CSCL 14/2

Several spectral coincidences between CO laser emission lines and infrared absorption lines of oxides of nitrogen have recently been observed. Using existing infrared spectroscopy data, we predict additional spectral coincidences; the Q-switched CO laser emits certain lines which overlap SO2 absorption lines, and certain frequency doubled CO2 laser lines overlap NO and CO absorption lines. Other spectral overlaps involving the CO2 laser have been reported elsewhere. Based on such coincidences remote sensing of these atmospheric constituents can be accomplished by observing resonant absorption, thermal emission, or fluorescence. The authors discuss sensitivities for each of these methods, using data on line strengths and pressure broadened line widths. Wide band heterodyne receivers offer high sensitivity when they can be used; our discussion included the use of this type of receiver system. Author (GRA)

N71-21843*# Cornell Univ., Ithaca, N.Y.
MOLECULAR ENERGY TRANSFER BY FLUID MIXING Progress Report, 1 Jan. 1968 – 1 Jan. 1971
Terrill A. Cool 4 Feb. 1971 23 p refs
(Contract NGL-33-010-064)
(NASA-CR-117503) Avail: NTIS CSCL 20E

Highlights are discussed of a program on the use of rapid mixing techniques and high speed flows for laser power enhancement. Three tasks are reviewed: (1) continuous wave chemical laser development, (2) N2-CO2 electrically excited fluid mixing laser techniques, and (3) gas dynamic mixing behind shock waves. Purely chemical HF and DF laser operation is also discussed. E.C.

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N71-20609# Ohio State Univ. Research Foundation, Columbus.
A STUDY OF THE MECHANISMS OF STRESS CORROSION CRACKING IN THE IRON-NICKEL-CHROMIUM ALLOY SYSTEM IN CHLORIDE ENVIRONMENTS Quarterly Report, 1 Dec. 1969 – 31 Mar. 1970
R. W. Staehle 24 Jun. 1970 62 p
(Contract AT(11-1)-2069)
(COO-2069-6) Avail: NTIS

Results of autoclave studies show that the performance of the higher-nickel alloys continued to improve as the Cl(−) + O2 is lowered into the 1 to 5 ppM range. In general, the Fe-Cr-Ni base alloys exhibit weight loss behavior typical of film covered materials. Grains from sensitized stainless steels were examined in the scanning electron microscope after they had been removed by chemical attack. The results defined the general distribution of chromium-depleted regions. Work on the time-dependence of reactions for film growth in acid and neutral solution demonstrated that certain portions of the kinetic behavior follow well-known inverse logarithm behavior. Results of the studies on Fe-Ni electrodes show that the specific rate constants for Fe and Ni dissolution in a given alloy are the same, providing the alloys are dissolving in the activated region of potentials where Tafel behavior applies. Author (NSA)

N71-20682# Rome Univ. (Italy). Inst. of Physics.
SOME CONSEQUENCES OF SUM RULES IN THE DYNAMIC SCALING APPROACH
D. Capocaccia, G. Ciccotti, and C. Di Castro 5 Jun. 1970 8 p refs *Its* Nota Interna No. 289
Avail: NTIS

Sum rules deduced from the equal time commutation relations are used to simplify the dynamic scaling assumption. Author (ESRO)

N71-20710# North American Rockwell Corp., Los Angeles, Calif.
THE INFLUENCE OF OXYGEN CONCENTRATION ON THE INTERNAL STRESS AND DISLOCATION ARRANGEMENTS IN ALPHA TITANIUM
A. W. Sommer and P. P. Tung (Calif. Univ., Los Angeles) Oct. 1970 26 p refs
(Contract N00014-67-C-0439)
(AD-716787; NA-70-719; TR-4) Avail: NTIS CSCL 11/6

The long range and thermally activated components of the flow stress in alpha-Ti have been measured by a stress relaxation

technique. Materials containing five different levels of oxygen, ranging from 250-5200 weight ppm were studied over the temperature range 200K-550K. The dislocation arrangements after relaxation have also been studied using thin foil electron microscopy techniques. In the higher oxygen materials it has been found that the internal stress varies more strongly with temperature than would be predicted by the temperature dependence of the elastic modulus; simultaneously, the thermally activated component of the flow stress goes through a maximum at the temperature where the internal stress becomes strongly temperature dependent. Thin foil results show that the maximum flow stress and rise of internal stress correspond to the onset of coplanar slip. An attempt to qualitatively rationalize this behavior is also made. Author (GRA)

N71-20725# Bureau of Mines, Washington, D.C.
HEAT OF FORMATION OF CUPROUS CYANIDE AND ITS HEAT CAPACITY FROM 10 TO 400 K
A. R. Taylor, Jr., Mary H. Brown, and Estelle G. Taylor Apr. 1971 15 p refs
(BMRI-7499) Avail: Issuing Activity

The heats of formation for CuCN(c) and HCN(l) were calculated to be 22.7 + or − 0.4 kcal/mole and 24.9 + or − 0.4 kcal/mole, respectively. The consistency heats of formation of HCN and NaCN was evaluated. Adiabatic calorimetric measurements between 10 and 400 K showed the entropy and heat capacity of CuCN(c) to be 21.51 + or − 0.06 eu and 14.58 + or − 0.04 cal/mole deg, respectively, at 298 K. A broad anomaly in the heat capacity was found in the temperature range 285 −320 K. The heat of transition associated with this anomaly was less than 1 cal/mole. Author

N71-20743* Battelle Memorial Inst., Richland, Wash.
LOW TEMPERATURE ALUMINUM ALLOY Patent
Philip C. Miller, Horace R. Ogden, Dean N. Williams, and Richard A. Wood, inventors (to NASA) Issued 17 Oct. 1967 (Filed 24 Jun. 1965) 6 p Cl. 75-142 Sponsored by NASA
(NASA-Case-XMF-02786; US-Patent-3,347,665; US-Patent-Appl-SN-466873) Avail: US Patent Office CSCL 11F

An aluminum casting alloy is reported that has the following composition in weight percent: copper, 3.90 to 4.50; cadmium, 0.08 to 0.12; magnesium, 0.06 to 0.10; titanium, 0.02 to 0.05; and the balance aluminum. The maximum total content of silicon, iron, chromium, manganese, vanadium and zinc impurities is 0.029 weight percent. This alloy exhibits high strength and toughness at extremely low temperatures so that it is particularly suitable for cryogenic applications in the aerospace field.
Official Gazette of the U.S. Patent Office

N71-20749# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ELASTIC MODULI OF TRANSITION METALS [MODULES ELASTIQUES DES METAUX DE TRANSITION]
Francois Ducastelle 1970 25 p refs In FRENCH; ENGLISH summary Submitted for publication
(ONERA-TP-848) Avail: NTIS

The elastic moduli of transition metals are studied in a model which assumes that the total energy of the crystal is given by the sum of a contribution of the d band calculated within the tight binding approximation of a Born-Mayer repulsive term. This model accounts for the variation of the atomic volume and elastic moduli along a transition series. It gives also the deviations from the Cauchy relations and the relative values of the elastic moduli for the FCC and HCP structures. BCC metals however do not fit with this description; they show a behavior which is probably related to details of the d band which are neglected here.
Author (ESRO)

N71-20809# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GENERAL REGULARITIES IN THE CORROSION OF METALS UNDER THE ACTION OF RADIOACTIVE RADIATION
A. V. Byalobzheskii 28 Oct. 1970 16 p refs Transl. into ENGLISH from Proc. of 3d Mezhdunarodnogo Kongressa po Korrozii Metallov, Tr., 1966 (USSR), v. 4, 1968 p 294−300
(AD-717065; FTD-HT-23-538-70) Avail: NTIS CSCL 11/6

It is shown that irradiation of metals affects the corrosion kinetics without changing the corrosion mechanism. The radiation effect on the corrosion of Fe, Cu, Zn, Ni, and Pb is discussed.
Author (GRA)

N71-20819# Norske Veritas, Oslo (Norway). Materialteknisk Avdeling.
BRITTLENESS AND CRACK FORMATION OF STEEL CASTINGS: AN INVESTIGATION OF INTERNAL CRACKS IN PISTON HEAD WITH 11 PERCENT CHROMIUM STEEL [SPROEHET OG SPREKKDANNELSE I STOEPESTAEL: EN UNDERSOEKELSE AV INDRE SPREKKER I STEMPELTOPP AV 11 PERCENT Cr STAEL]
G. Wold and T. Kristoffersen 16 Oct. 1969 22 p refs In NORWEGIAN; ENGLISH summary Sponsored by Roy. Norweg. Council for Sci. and Ind. Res.
Avail: NTIS

Ultrasonic testing of a piston head in a marine engine showed internal defects in the material. The defects (flakes) were found in the transition between crown and skirt, and the piston head had to be discarded. A piece of the material from the defective area and smaller samples from the skirt were closely examined. The sample taken from the defective area was deep-etched, and in this state some darker lines or "veins" could be seen on the surface. The material has been studied to find the causes of the internal defects, and special attention has been given to the possible influence of hydrogen, shrinkage strains, and the "dark veins". Author (ESRO)

N71-20860# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
THE NBS ALLOY DATA CENTER: PERMUTED MATERIALS INDEX
G. C. Carter, D. J. Kahan, L. H. Bennett, T. R. Cuthill, and R. C. Dobbyn Mar. 1971 687 p refs
(NBS-Spec-Publ-324) Avail: SOD $7.00 Catalog No. C-3.10:324

Literature references to approximately 10,000 research papers on physical properties of metals and alloys are presented. The index contains all NMR Knight shift papers and soft X-ray emission papers. It also contains many soft X-ray absorption papers and a number of papers on generally related topics such as susceptibilities, specific heats, hyperfine fields, and band structures. The papers are annotated in depth and the coded information put onto a magnetic tape. The Permuted Materials Index was created from this tape, listing alloys under each of their constituent components. Author

N71-20865# Oak Ridge National Lab., Tenn.
EXAMINATION OF NICKEL HEAT PIPES CONTAINING POTASSIUM
J. H. De Van and D. H. Jansen Dec. 1970 62 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3077) Avail: NTIS

Three heat pipes constructed of pure nickel that contained potassium as a working fluid were examined after operation at 600 C for 6000 to 10,000 hr. No deterioration of the pipes was indicated during operation, and visual examination confirmed that no serious corrosion occurred under the test conditions. Metallographic examination did reveal local areas of the evaporator in which the capillary wick and adjacent pipe wall had been attacked and the attendant formation of a black oxide scale, which appeared to be a double oxide of the type Ni sub x O sub y K sub z. Metallographic

examination of the condenser area revealed no metallurgical changes other than grain growth. After the test, the potassium contained 50 to 120 ppM O and less than 50 ppM metal impurities. Author (NSA)

N71-20866# Joint Publications Research Service, Washington, D.C.

PHYSICO-CHEMICAL PRINCIPLES OF CRYSTALLIZATION PROCESSES USED IN THE SUPERPURIFICATION OF METALS

V. N. Vidorovich, ed. 8 Mar. 1971 214 p refs Transl. into ENGLISH of the book 'Fiziko-Khimicheskiye Osnovy' Kristallizatsionnykh Protessov Glubokoy Ochistki Metallov' Moscow Nauka Press, 1970 p 7-163

(JPRS-52552) Avail: NTIS

Papers are presented on the theory of crystallization methods, behavior of impurities, crystallization of metals in compound form, and influence of procedural and mechanical factors for the superpurification of metals. For individual titles, see N71-20867 to N71-20892. N.E.N.

N71-20867# Joint Publications Research Service, Washington, D.C.

MATHEMATICAL METHODS FOR STUDYING PHYSICO-CHEMICAL CHARACTERISTICS OF BEHAVIOR OF IMPURITIES IN ZONAL RECRYSTALLIZATION

A. E. Volpyan *In its* Physico-Chem. Principles of Crystallization Processes Used in the Superpurif. of Metals 8 Mar. 1971 p 1-14 refs (See N71-20866 10-17)

Avail: NTIS

A method of approximation has been developed wherein increased accuracy can be achieved without reducing the size of the jump and which would produce reasonably simple mathematical expressions for determining concentration. Author

N71-20868# Joint Publications Research Office, Washington, D.C.

THEORY OF USE OF COLUMNS FOR COUNTERFLOW CRYSTALLIZATION OF A MELTED MASS

G. G. Devyatykh et al *In its* Physico-Chem. Principles of Crystallization Processes Used in the Superpurif. of Metals 8 Mar. 1971 p 14-23 refs (See N71-20866 10-17)

Avail: NTIS

Equations are presented that describe the operation of a counterflow crystallization column in the steady state and the nonrecovery and recovery modes. By way of example of the separation of the benzene-thiophene mixture it is shown that the equations derived are in satisfactory agreement with experimental data. It is also shown that the effectiveness of the crystallization column per unit cross section can be the same as in rectification. Author

N71-20870# Joint Publications Research Service, Washington, D.C.

FEATURES OF THE BEHAVIOR OF IMPURITIES IN REFINEMENT OF SEVERAL LOW MELTING METALS BY ZONE MELTING

B. N. Aleksandrov et al *In its* Physico-Chem. Principles of Crystallization Processes Used in the Superpurif. of Metals 8 Mar. 1971 p 30-38 refs (See N71-20866 10-17)

Avail: NTIS

The results of efforts to produce pure metals, tin, bismuth, zinc, and linthium, are described. These investigations used successfully either two or three physical methods: high temperature vacuum heating, vacuum distillation, and the concluding step, zone melting. Spectral or chemicospectral analysis was employed for control of the concentration and redistribution of the impurities. An additional method of controlling the purity of the metal, the residual strength measurement method which records the level of overall purity of the metal product, was also used. Zone melting was performed in crucibles made of various materials of length L approximately 900 mm at a zone migration rate v = 25 mm/hour and liquid zone length of 40-60 mm. The liquid zones were created by resistance furnaces located outside of a quartz tube, within which was placed, in an inert atmosphere of argon or helium, the crucible with the metal to be purified. Purities obtained by use of these complex refinement methods were: Sn, Bi, and Zn = 99.9999%; and Li = 99.999%. A.L.

N71-20871# Joint Publications Research Service, Washington, D.C.

PHYSICO-CHEMICAL FUNDAMENTALS OF ZONE RECRYSTALLIZATION OF MAGNESIUM

A. I. Belyayev et al *In its* Physico-Chem. Principles of Crystallization Processes Used in the Superpurif. of Metals 8 Mar. 1971 p 38-47 refs (See N71-20866 10-17)

Avail: NTIS

Analysis of magnesium-impurity binary diagrams of state show that the zone recrystallization method can be used successfully for the production of superpure magnesium. A classification is proposed for impurities in magnesium on the basis of the character of their behavior during the course of zone recrystallization. The correlative relations between the distribution ratio of impurities and their position in the period system have been determined. The effect of the rate of crystallization on impurity removal efficiency was investigated. The effective distribution ratios of the impurities aluminum, silicon, and copper were determined; the equilibrium distribution ratios that agree satisfactorily with the values obtained from the diagrams of state were determined by extrapolation to the zero rate. Tests of mechanical properties revealed that zone refined magnesium has much greater plasticity than magnesium refined by the distillation method. This investigation shows that magnesium refined by the zone recrystallization method is a superpure metal. Author

N71-20872# Joint Publications Research Service, Washington, D.C.

EFFECT OF THIRD COMPONENT ON ALUMINUM REFINING BY ZONE MELTING

A. I. Yukova et al *In its* Physico-Chem. Principles of Crystallization Processes Used in the Superpurif. of Metals 8 Mar. 1971 p 48-55 refs (See N71-20866 10-17)

Avail: NTIS

Analysis of the results of experimental investigations revealed that the stronger and more stable the chemical compound (impurity-additive), the more effective the third component is in extracting impurities from aluminum. It is shown that the introduction of additives to aluminum in quantities greatly exceeding the theoretical quantity required for the formation of intermetallides with impurities, leads to a reduction in impurity extraction efficiency. It is pointed out that the principles derived concerning the influence of various additives on impurity distribution in zone recrystallization of aluminum are apparently valid for other metals as well, although there are unquestionably certain features that are related to the physico-chemical properties of the purified metal. Author

N71-20873# Joint Publications Research Service, Washington, D.C.

INVESTIGATION OF PHYSICO-CHEMICAL FEATURES OF BEHAVIOR OF SELENIUM IMPURITY IN TELLURIUM IN ZONE RECRYSTALLIZATION

G. I. Shuleshko *In its* Physico-Chem. Principles of Crystallization Processes Used in the Superpurif. of Metals 8 Mar. 1971 p 55-63 refs (See N71-20866 10-17)

Avail: NTIS

The behavior of the impurity selenium in tellurium during horizontal zone recrystallization in a nitrogen flow at various zone travel rates, for various numbers of passes, and initial concentrations of selenium in the tellurium was investigated. It is shown that the distribution of selenium impurity in tellurium is close to the Pfann distribution. The equilibrium distribution ratios of selenium impurity in tellurium were calculated for various initial selenium concentrations. The microdiagram of the Te-Se system in the range of low selenium concentrations was constructed. Author

N71-20874# Joint Publication Research Service, Washington, D.C.

INVESTIGATION OF BEHAVIOR OF IMPURITIES IN NONCRUCIBLE ZONE MELTING OF REFRACTORY METALS

Sh. I. Peyzulayev *In its* Physico-Chem. Principles of Crystallization Processes Used in the Superpurif. of Metals 8 Mar. 1971 p 64–76 refs (See N71-20866 10-17)

Avail: NTIS

The impurity in a tested material may be present not only in some chemical state, but also simultaneously in several chemical forms. Since these compounds of the same impurity possess different physicochemical properties, calculation of its behavior during zone melting is complicated. These two possible situations were examined separately: (1) evaporation of impurity present only in one chemical state; and (2) evaporation of impurity simultaneously in several different chemical states. Results of these experiments are presented in graphical and tabular form. A.L.

N71-20875# Joint Publications Research Service, Washington, D.C.

IMPURITY DISTRIBUTION IN MOLYBDENUM MONOCRYSTALS PRODUCED BY ELECTRON BEAM ZONE MEETING

Sh. I. Peyzulayev et al *In its* Physico-Chem. Principles of Crystallization Processes Used in the Superpurif. of Metals 9 Mar. 1971 p 76–84 refs (See N71-20866 10-17)

Avail: NTIS

The behavior of metallic impurities and their compounds (carbides, oxides), based on previously developed theoretical premises, was investigated. Also presented are the results of certain experimental investigations which partially illustrate the degree of reliability of the data derived from preliminary calculations. Theoretical formulas and some of the data required for evaluating the evaporation of impurities during noncrucible zone melting are presented. These calculations were made for the case of zone refining of molybdenum. A.L.

N71-20876# Joint Publications Research Service, Washington, D.C.

INVESTIGATION OF IMPURITY DISTRIBUTION AND CONVECTION IN MELT DURING ZONE RECRYSTALLIZATION OF TELLURIUM TETRACHLORIDE

V. V. Krapukhin et al *In its* Physico-Chem. Principles of Crystallization Processes Used in the Superpurif. of Metals 8 Mar. 1971 p 85–89 refs (See N71-20866 10-17)

Avail: NTIS

Zone recrystallization of tellurium tetrachloride was accomplished at zone movement rates of 0.6, 1.0, 2.0, and 3.0 cm/hour. After one pass of the molten zone the concentration of impurities that are hard to remove from elemental tellurium (Al, Fe, Bi, Si) was reduced considerably. Comparison of the distribution ratios (Al, Fe, Bi, Si) during zone recrystallization of elemental tellurium and of its tetrachloride shows that refinement of the latter is more effective. After ten zone passes at 3 cm/hour the concentration of all monitored impurities in tellurium tetrachloride was lower than the limit of sensitivity of spectral analysis. The convective flows in the melted zone of the ingot were investigated by motion photography. The character of convective flows, rate of motion of the particles, and shape of the crystallization front were established and the conclusion was reached that the thermal fields in the melted zone of the ingot have a great effect on the efficacy of zone recrystallization. Author

N71-20877# Joint Publications Research Service, Washington, D.C.

CRYSTALLIZATION REFINEMENT OF LOWER INDIUM CHLORIDES

P. I. Fedorov et al *In its* Physico-Chem. Principles of Crystallization Processes Used in the Superpurif. of Metals 8 Mar. 1971 p 89–97 refs (See N71-20866 10-17)

Avail: NTIS

The diagram of state of the middle part of the indium-indium chloride system has been corrected. The reaction of the lower indium chlorides InCl and In_2Cl_3 with the chlorides of thallium, zinc, lead, aluminum, and certain other metals was investigated. The behavior of tin during zone melting of the lower indium chlorides InCl, In_2Cl_3, In_4Cl_7 and eutectic In_4Cl_7 + $InCl_2$ is discussed. The distribution of impurities copper, silver, iron, and nickel during zone melting of In_2Cl_3 was analyzed, and the effective distribution ratios of these impurities at various initial concentrations were determined. All impurities had distribution ratios less than unity and were extracted by zone melting to the end of the ingot. Author

N71-20879# Joint Publication Research Service, Washington, D.C.

INVESTIGATION OF EFFICACY OF ZONE REFINEMENT OF BISMUTH, TELLURIUM AND THEIR COMPOUNDS

N. M. Konysheva et al *In its* Physico-Chem. Principles of Crystallization Processes used in the Superpurif. of Metals 8 Mar. 1971 p 108–112 refs (See N71-20866 10-17)

Avail: NTIS

Factors that influence the formation of solid solutions in compound-impurity and compound components-impurity systems were compared. The behavior of impurities during crystallization refining of elements and semiconductor compounds synthesized from them verified the advantage of the refinement of the compound over the refinement of its components. It is also shown that a semiconductor compound with a broad range of homogeneity is harder to refine by the crystallization method than compounds with a narrow range of homogeneity. Author

N71-20880# Joint Publications Research Service, Washington, D.C.

NEW METHODS OF INTENSIFICATION OF CRYSTALLIZATION PROCESSES USING A MOBILE MAGNETIC FIELD

K. M. Rozin *In its* Physico-Chem. Principles of Crystallization Processes Used in the Superpurif. of Metals 8 Mar. 1971 p 113–122 refs (See N71-20866 10-17)

Avail: NTIS

Methods of induced circulation of melts under the influence of a mobile magnetic field (MMF) were examined. The usual methods of creating MMF were analyzed and new methods of creating MMF based on electromagnets of the ac motor stator type are described. A method of creating MMF using coreless solenoids, and methods of creating MMF in which the energy of the magnetic field of resistance heaters was used are described. The influence of MMF created by the new electronagmet-heater method on superrefining processes was investigated. It is shown that the use of MMF improves the refining efficiency of aluminum and cadmium from copper impurity. Author

N71-20881# Joint Publications Research Service, Washington, D.C.

CHOICE OF CONDITIONS OF ELECTROMAGNETIC ZONE MIXING OF MELT IN ZONE MELTING OF METALS

A. A. Belskiy et al *In its* Physico-Chem. Principles of Crystallization Processes used in the Superpurif. of Metals 8 Mar. 1971 p 122–128 refs (See N71-20866 10-17)
Avail: NTIS

The effect of the intensity and direction of zone mixing of molten metal on the refining efficiency of gallium during zone recrystallization was examined. Turbulent motion of the metal in the zone provided the optimal separation conditions. The direction of motion of the molten metal in the zone relative to the horizontal axis of the ingot had no substantial effect on refining efficiency. The quantitative relationship between refining efficiency and the basic indices of magnetic melt mixing was determined experimentally in the investigation of the process of zone melting of gallium. The use of similarity theory made it possible to convert the results obtained for gallium to conditions of electromagnetic melt mixing during zone melting of metals and intermetallic compounds. Author

N71-20882# Joint Publications Research Service, Washington, D.C.
EFFECT OF TECHNOLOGICAL AND MECHANICAL FACTORS ON RESULTS OF ALUMINUM REFINING BY ZONE MELTING METHOD
S. Ye. Marayev *In its* Physico-Chem. Principles of Crystallization Processes Used in the Superpurif. of Metals 8 Mar. 1971 p 128–135 refs (See N71-20866 10-17)
Avail: NTIS

Investigation of the vaporization of magnesium impurity from a high purity aluminum melt in a vacuum revealed that the concentration of magnesium in the metal depends chiefly on the aging time of the melt in the vacuum, and reduction of the concentration of magnesium impurity is accompanied by reduction of the residual electrical resistance of the aluminum. It was established that the aging of highly pure aluminum melt for 20 hours at 720 C to 740 C in vacuum results in adequate elimination of volatile impurities and gas, and such preliminary treatment of the initial aluminum facilitates the subsequent zone refining process and increases its productivity and efficiency. Comparisons of the average refinement results achieved with apparatus for the zone refinement of aluminum using electrical resistance heating and induction heating indicate that induction heating of the metal is favored for industrial applications. A.L.

N71-20883# Joint Publications Research Service, Washington, D.C.
RESULTS OF INVESTIGATION OF OPERATION OF EXPERIMENTAL INSTALLATION FOR CONTINUOUS ZONE RECRYSTALLIZATION FOR ANTIMONY REFINING
V. N. Vidorovich et al *In its* Physico-Chem. Principles of Crystallization Processes Used in the Superpurif. of Metals 8 Mar. 1971 p 135–150 refs (See N71-20866 10-17)
Avail: NTIS

The features of crystallization refinement of material from various types of impurities under conditions of continuous counterflow of the solid and liquid phases, created in equipment with horizontal charging by the mass transfer method of continuous zone recrystallization, were examined. The possibility of production of pure and very pure antimony of constant chemical composition, using various commercial grades of the material, was confirmed and certain behavioral features of individual impurities during continuous zone refining of antimony were revealed. The reduction in refining efficiency brought about by increasing the rate of crystallization and improvement of impurity extraction by increasing the rate of rotation of the mixer, which creates a deficiency of the melt in the zone, were investigated. The possibility of increasing the capacity of the process by increasing the amounts of decanted product of the initial zone, which has no effect on the purity of the antimony obtained, is pointed out. Author

N71-20891# Joint Publications Research Service, Washington, D.C.
MECHANICAL-PROCEDURAL FEATURES OF CONTINUOUS ZONE REFINING UNDER FLUX
V. N. Vigdorovich et al *In its* Physico-Chem. Principles of Crystallization Processes used in the Superpurif of Metals 8 Mar. 1971 p 188–193 refs (See N71-20866 10-17)
Avail: NTIS

The mechanical-procedural features of the operation of single section apparatus of zone-transport and zone-vacuum recrystallization under flux are reviewed. Also presented are results of experiments in antimony refining using sodium metaphosphate as the flux. A.L.

N71-20892# Joint Publications Research Service, Washington, D.C.
TESTING UNIT FOR INVESTIGATION OF ELECTROMAGNETIC MIXING OF MELT DURING ZONE RECRYSTALLIZATION
A. S. Zherebovich *In its* Physico-Chem. Principles of Crystallization Processes used in the Superpurif. of Metals 8 Mar. 1971 p 193–196 refs (See N71-20866 10-17)
Avail: NTIS

A test stand, designed for full scale and model analysis of the mixing of a melt by the traveling flat electromagnetic field of a mixer of the electromagnetic track type during zone recrystallization, is described. The test unit consists of: inductor power source; flat traveling electromagnetic field inductor; coordinator; quartz ampule; gas vacuum distributor; inert gas cylinder; vacuum assembly; and shelves with measurement instruments. The mixing modes were investigated on model materials of gallium and indium, and on full scale materials of bismuth and indium antimonide. A.L.

N71-20913# National Bureau of Standards, Washington, D.C.
STANDARD REFERENCE MATERIALS: NATIONAL BUREAU OF STANDARDS–US STEEL CORPORATION JOINT PROGRAM FOR DETERMINING OXYGEN AND NITROGEN IN STEEL
J. F. Martin Feb. 1971 42 p refs
(NBS-SP-260-26) Avail: SOD $0.50

A method for the rapid and simultaneous determination of small concentrations of oxygen and nitrogen in steel is described. The apparatus consists of an inert gas fusion system coupled to a gas chromatograph. The detection limit is less than 1 ppm for both oxygen and nitrogen, and the analysis time is about five minutes. F.O.S.

N71-20914# Virginia Polytechnic Inst., Blacksburg. Dept. of Engineering Mechanics.
A CORRELATION BETWEEN PULSE-ECHO ULTRASONIC ATTENUATION AND HARDNESS
K. Reifsnider and S. Sawyer Dec. 1970 22 p refs
(Contract DAAF07-69-C-0444)
(AD-717099; VPI-E-70-23) Avail: NTIS CSCL 14/2

Nondestructive evaluation and characterization of materials, especially in terms of parameters critical to modern design and fabrication, is a problem of growing magnitude. One example of this problem is the inability of any present nondestructive test technique to definitely establish the yield strength of a fabricated section of steel, especially if spacial gradients of material properties occur. The present report describes some results of one nondestructive method which does offer some improvement in such capabilities and indicates a direction for continued development. In particular, a theoretical correlation is established between pulse-echo ultrasonic attenuation values and hardness for alloys with variable impurity content. Experimental tests which qualitatively support the correlation are also described. Author (TAB)

N71-20920# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THERMAL STABILITY OF MATERIALS AND STRUCTURAL ELEMENTS: SELECTED ARTICLES

O. N. Duliba et al 23 Oct. 1970 46 p refs Transl. into ENGLISH from Termoprochnost Materialov i Konstrukti'vnykh Elemontov (Moscow), no. 5, 1969 46 p

(AD-717012; FTD-HT-23-503-70) Avail: NTIS CSCL 11/6

Contents: Certain regularities in the change of strength characteristics of molybdenum and niobium in an oxidizing medium; High-temperature vibration strength of certain steels and alloys based on titanium and aluminum; Study of the fatigue life of heat-resistant alloy of gas turbine engine blades with consideration of operational force and combustion loading; and Effect of high frequency heating on fatigue strength of heat-resistant steel EI612 and heat-resistant alloys EI437B and ZhS-6K. GRA

N71-20941* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

HIGH TEMPERATURE COMPOSITIONS Patent

Roger A. Long, inventor (to NASA) Issued 31 Oct. 1967 (Filed 23 Nov. 1960) 4 p Cl. 106-55 Continuation-in-part of US Patent Appl. SN-652358, filed 12 Apr. 1957 which is a continuation-in-part of US Patent Appl. SN-177548, filed 3 Aug. 1950

(NASA-Case-XMS-00370; US-Patent-3,350,214; US-Patent-Appl-SN-71366) Avail: US Patent Office CSCL 11F

A method for producing refractory molybdenum disilicides is described with the properties and uses of the compound. The method is based on the discovery that when a stochiometric mixture corresponding to the formula MoSi2 of fine particles of molybdenum and silicon is heated to 2000 F, a reaction occurs which results in the production of friable molybdenum disilicide which is suitable for powder metallurgy processing. When compacted under pressure and heat, it yields a cemented MoSi2 with desirable properties for high temperature applications. F.O.S.

N71-21008# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.

STANDARD REFERENCE MATERIALS: A STANDARD REFERENCE MATERIAL CONTAINING NOMINALLY FOUR PERCENT AUSTENITE

G. E. Hicho, H. Yakowitz, S. D. Rasberry, and R. E. Michaelis Feb. 1971 24 p refs

(NBS-Spec-Publ-260-25) Avail: SOD $0.30 Catalog No. C13.10:260-25

This standard was produced by power metallurgical techniques using known amounts of austenite. Using these techniques, 134 specimens were prepared. Because these standards are expected to be used primarily for the calibration of X-ray diffraction equipment, only one surface of each standard is certified, and these surfaces range from 3.1 percent to 5.2 percent in austenite content. To make the specimens, 310 stainless steel powder (austenitic) was blended with 430 stainless steel powder (ferritic) to make a mixture of 5 percent austenite in ferrite. The material was compacted, sintered, polished and etched so the austenite appears white and the ferrite, a deep brown. Then quantitative microscopy methods were used to determine the percentage of austenite near the surface. Furthermore, the 310 power contains 20 percent of nickel while the 430 powder contains virtually no nickel. Therefore, after establishing a meaningful calibration curve, X-ray fluorescence analysis for the nickel content was also used as a direct measurement of the amount of austenite on the surface of the compact. Both procedures were carried out on fifteen specimens statistically selected from the total number of compacts produced. Agreement, within experimental error limits, was obtained between the X-ray fluorescence results and quantitative microscopy results. The X-ray fluorescence method was used to characterize all additional compacts. X-ray diffraction determinations of austenite content are in good agreement with the X-ray fluorescence and quantitative microscopy results. The compacts may be used as X-ray diffraction standards for austenite or in special cases as X-ray fluorescence standards for nickel content. Author

N71-21012# Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway). Stoeperilaboratoriet.

CRYSTALLIZATION AND CASTING ERRORS. STATE-OF-THE-ART AS OF 31 DECEMBER 1968 [KRYSTALLISASJON OG STOEPEFEIL. OVERSIKT PR. 31.12.68]

V. de L. Davies and A. Engebretsen 7 Jan. 1969 25 p ref In NORWEGIAN; ENGLISH summary Sponsored by Roy. Norweg. Council for Sci. and Ind. Res.

Avail: NTIS

Studies of pipe formation and feeding distance have been carried out for sand-cast aluminum alloys. The feeding problems are greater at larger sheet sections. Microporosity, macroporosity (pipes), and external suction have been registered lengthwise in the sheets for various sheet and feeder sizes and at different casting temperatures. Author (ESRO)

N71-21013# Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway). Stoperilaboratoriet.

HOT FISSURES [VARMSPREKKER]

V. de L. Davies 16 Dec. 1968 45 p refs In NORWEGIAN; ENGLISH summary Sponsored by Roy. Norweg. Council for Sci. and Ind. Res.

Avail: NTIS

General studies of the formation of hot fissures have been made for alloys with low melting point, and measurements of hot fissures have been carried out for aluminum and some aluminum alloys. Apart from the solidification contraction, the most important cause of hot fissure formation is the grain size of the metal and the alloy. The length of the hot fissures increases rapidly with increase of grain size. Additions which influence the distribution in the residual melt will also influence the length of the hot fissures, but as a rule the influence of the addition will be due to the grain size. At a given grain size the hydrogen content in the alloys will reduce the length of the hot fissures. Author (ESRO)

N71-21016# Oak Ridge National Lab., Tenn.

EFFECT OF FAST NEUTRON IRRADIATION ON THE CREEP RUPTURE PROPERTIES OF TYPE 304 STAINLESS STEEL T 600 C

E. E. Bloom and J. O. Steigler Jan. 1971 23 p refs

(Contract W-7405-eng-26)

(ORNL-TM-3169) Avail: NTIS

The creep rupture properties of Type 304 stainless steel have been determined at 600 C after irradiation at temperatures in the range 370 to 600 C by fast-neutron fluences. The microstructures were characterized by electron microscopy. Irradiation at 370 to 470 C caused a decrease in ductility and rupture life which became larger with increasing fast neutron fluences. The irradiated specimens fractured along the grain boundaries with no evidence of deformation within the matrix. The increased tendency for grain boundary fracture, and thus reduced ductility and rupture life, appears to result from the effects of the irradiation-produced voids and dislocations upon the deformation processes which would be operative in an unirradiated specimen. The voids and dislocations prevent dislocation motion within the matrix. Regions along grain boundaries are denuded of these defects and grain boundary sliding occurs. Author

N71-21017# Westinghouse Electric Corp., Pittsburgh, Pa. PWR Systems Div.

HEAVY SECTION STEEL TECHNOLOGY PROGRAM.

TECHNICAL REPORT NO. 11: NOTCH PREPARATION IN COMPACT TENSION SPECIMENS

T. R. Mager Nov. 1970 31 p refs Prepared for ORNL
(Contract W-7405-eng-26)
(WCAP-7579) Avail: NTIS

The effects of fatigue precrack stress level, corrosive environment, and brittle crack initiation were evaluated on the fracture toughness of A533 Grade B Class 1 Steel. Fatigue precracking was done at two different temperatures and two different stress intensity levels. Results indicated that notch preparation is an important factor in fracture toughness testing. In addition, it was shown that use of an electron beam starter weld would be feasible as a means to initiate a flaw for simulated pressure vessel service tests. Author (NSA)

N71-21027# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.

STANDARD REFERENCE MATERIALS: HOMOGENEITY CHARACTERIZATION OF Fe-3Si ALLOY

H. Yakowitz, C. E. Fiori, and R. E. Michaelis Feb. 1971 32 p refs
(NBS-Spec-Publ-260-22) Avail: SOD $0.35 Catalog No. C13.10:260-22

An alloy of iron-3.22 wt. pct. silicon (Fe-3Si) was characterized with regard to chemical homogeneity of iron and silicon at the micrometer level of spatial resolution. This alloy is satisfactory for use as a homogeneous standard for electron probe microanalysis. The samples were cut from coarse grained sheet stock to a final size of about 3 mm x 3 mm x 0.28 mm thick. Homogeneity was checked by means of quantitative raster scanning in which a square matrix (1.1 mm x 1.1 mm) of individual points is analyzed by the microprobe. Each matrix represents 400 separate analyses. Usually, the same matrix was rerun so that each point was sampled twice. The coefficient of variation for both the iron and silicon is less than one percent. Quantitative microprobe analysis was also carried out on this alloy giving a silicon content of 3.14% and an iron content of 96.9%. Author

N71-21048 National Lending Library for Science and Technology, Boston Spa (England).

MODIFICATION AND MICROALLOYING OF STEELS BY SOME MINOR AND RARE EARTH METALS

M. P. Braun 24 Aug. 1970 5 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), v. 12, no. 12, 1969 p 108–113 In ENGLISH and RUSSIAN
(NLL-Trans-746-563(9022.401); NLL-LTI-737-7126) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL Photocopy Coupon

The mechanism of the effect of minor and rare earth metals on the properties of various alloyed steels was studied. The properties studied include: surface tension, reduction in size of recooled iron and steel, free energy of austenitic grain boundaries and grain size. The effect of the addition of mishmetal in varying amounts on the mechanical properties of steels is also discussed. F.O.S.

N71-21051# National Lead Co. of Ohio, Cincinnati.

ELEVATED-TEMPERATURE TENSILE TESTS OF CAST URANIUM-BASE DILUTE QUINARY ALLOYS

P. O. Randall and R. E. DuVall Nov. 1970 9 p refs
(Contract AT(30-1)-1156)
(NLCO-1060) Avail: NTIS

Cast uranium-base alloys containing additions of 1000 ppM or less of carbon, iron, silicon, and aluminum were tensile tested at temperatures of 885, 1025, and 1150 F. An alloy containing 1000 ppM C, 1000 ppM Fe, 1000 ppM Si, and 1000 ppM Al exhibited the best combination of low temperature strength with high temperature ductility. Author (NSA)

N71-21144# Ecole Nationale Superieure de Mecanique, Nantes (France). Lab. de Metallurgie.

USE OF THE LATIN SQUARE TO STUDY THE INFLUENCE OF THE INITIAL STATE ON TEMPERING ABILITY OF NON-ALLOYED STEELS [ESSAI D'UTILISATION DU PLAN EN CARRE LATIN POUR ETUDIER L'INFLUENCE DE L'ETAT INITIAL SUR LA TREMPABILITE DES ACIERS NON ALLIES]

R. Moreau, A. Ducoin, and C. Bouchy *In its* Ann. of Mech. Semiann. Rept., 1969 p 275–303 In FRENCH (See N71-21133 10-32)
Avail: NTIS

Tests have been performed on two types of non-alloyed steels to ascertain their tempering ability. These tests include two different heating programs, from different initial states of the steel bars (different heat treatments), four different values of the temperature at which the transformation to austenitic steel is performed, and four different durations of the heating at this temperature. Statistical analysis of the results, using a latin square, for a three degree of variation, shows that the temperature factor is very important, whereas the initial state and the duration are much less significant. A micrographic analysis of the crystal lattices is also presented. ESRO

N71-21145# Ecole Nationale Superieure de Mecanique, Nantes (France).

DESIGN OF AN ELECTROLYTIC SEPARATION METHOD FOR CARBIDES IN HIGH TEMPERATURE RESISTANT STAINLESS STEELS CONTAINING 25% Cr - 20% Ni [MISE AU POINT D'UNE SEPARATION ELECTROLYTIQUE DES CARBURES DANS LES ACIERS INOXYDABLES REFRACTAIRES DE NUANCE 25% Cr - 20% Ni]

M. Geier and F. Gobin *In its* Ann. of Mech. Semiann. Rept., 1969 p 305–342 refs In FRENCH (See N71-21133 10-32)
Avail: NTIS

The electrochemical extraction of carbides and its quantitative analyses from high temperature resistant stainless steels is discussed. Four different electrolytes suitable to extract chromium carbides are discussed with two types of steels. ESRO

N71-21209# Washington Univ., Seattle. Dept. of Aeronautics and Astronautics.

DYNAMIC FRACTURE IN METALS UNDER BIAXIAL STRAIN CONDITIONS

Robert M. Schmidt and Ian M. Fyfe Oct. 1970 53 p refs
(Grant DA-ARO(D)-31-124-G91)
(AD-717092; AROD-9504-1-E) Avail: NTIS CSCL 11/6

An experiment to investigate the influence of biaxial strain on the dynamic fracture of metals is outlined. A hollow cylindrical specimen is loaded on the inner diameter by a polyethylene coated exploding wire which results in a circumferential spallation pattern. Prior to fracture, the spall plane undergoes biaxial deformation with a total hoop strain of the same order of magnitude as the total radial strain. The role of plastic pre-straining on the fracture threshold is shown to be negligibly small as evidenced by a series of tests where the specimens were statically and dynamically prestrained in the radial, tangential, and axial directions. Kerr cell pictures of the coated exploding wires and dynamic flash X-rays of the specimens are included to demonstrate the axi-symmetry of both the loading and the spall phenomena. Author (GRA)

N71-21216 National Lending Library for Science and Technology, Boston Spa (England).

CARBIDE PRECIPITATION AND CARBIDE EQUILIBRIUM IN 18/8 STEELS

H. Tuma et al 10 Jul. 1970 7 p refs Transl. into ENGLISH from Neue Huette (East Germany), v. 14, no. 6, Jun. 1969

p 355-357
(NLL-CE-Trans-5391-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Taking an austenitic 18/8 stainless steel as example, it is shown that the results from extracting the carbides in isothermally annealed specimens correspond closely to theoretical ideas about the kinetics of precipitation. The carbide concentrations obtained by extraction are smaller than the results obtained from equilibrium investigations under an H2/CH4 atmosphere. This is attributed to a decarburization of these steels during extended annealing at elevated temperatures. Just as for the material investigated, it can be taken that for some other composition, phase analysis by extraction of the carbides and analysis of the equilibrium state under a gasous atmosphere can be a valuable guide in selecting a material, in determining kinetic values and thermodynamic data, and in assessing the behavior during long-term annealing. Author

N71-21217 National Lending Library for Science and Technology, Boston Spa (England).
STUDIES OF METAL DEFICIENCY IN (Co Mg) O AND (Co Ni) O SYSTEMS
G. Zintl 18 Aug. 1970 18 p refs Transl. into ENGLISH from Z. Phys. Chem. (West Germany), v. 48, no. 516, 1966 p 340-358
(NLL-CE-Trans-5279-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.

Metal deficiency in the mixed oxides (Co, Mg)O and (Co, Ni)O in equilibrium with a gas phase with P(O2 = 0.21 and 2.8 x 0.0028 atm. at 1000/C was determined as a function of the mole fraction of MgO or NiO by titration of the trivalent cations. The sharp drop observed in the concentration of trivalent cations with increasing concentration of MgO or NiO can be explained by disturbance of the quantum-mechanical resonance between Co(2+) and Co(3+) with the incorporation of foreign ions. According to the literature, the rate of oxidation of Co-Ni alloys decreases substantially with increasing Ni content, which can be explained by a reduction in the concentration of cation vacancies in the oxide film which is formed. A comparison with experimental values of the present work shows qualitative agreement. Author

N71-21218 Pittsburgh Univ., Pa.
INVESTIGATION OF THE COPPER-RICH PORTION OF THE COPPER-NIOBIUM SYSTEM
Manuel Tubino Sinibaldi (Ph.D. Thesis) 1969 101 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 70-5290

The phase boundaries of the copper-rich end of the copper-niobium system were reinvestigated by differential thermal analysis and electromotive force measurements. The alloys were prepared by an induction melting and chill casting technique, after it was found that arc melting resulted in the formation of a niobium-rich envelope during cooling. Differential thermal analysis studies of nine alloys, ranging from 0.15 to 10 per cent niobium, and heated to 1200 C, yielded data for the determination of the solidus line. The results demonstrate that the current designation of the copper-niobium system as a peritectic is in error. The data show that this system is a eutectic, with the eutectic invariant at 1067.5 C and at 97 weight per cent copper. This work has also demonstrated that the half-cell method with some modifications can be used to obtain emf data for solid alloy systems with extremely low oxygen partial pressure. Dissert. Abstr.

N71-21219 National Lending Library for Science and Technology, Boston Spa (England).
EFFECT OF HEAT TREATMENT ON PROPERTIES OF CHEMICALLY DEPOSITED NICKEL COATINGS [VLIV TEPELNEHO ZPRACOVANI NA VLASTNOSTI CHEMICKY VYLOUCENYCH NIKLOVYCH POVLAKU]
A. Vojtiskova 21 Aug. 1970 3 p Transl. into ENGLISH from Koroze Ochr. Mater. (Prague), v. 13, no. 1, 1969 p 5-6 In ENGLISH and CZECHOSLOVAKIAN
(NLL-Trans-746-599-(9022.401); NLL-LTI-734-4545) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

During annealing at 400 C and 1 hr, fine particles of Ni3P are already perceptible in the whole section of the coating. With annealing at 550 C, this distinction between both parts of the coating disappears and a coarsening of the precipitate occurs. At the same time, interlaying diffusion emerges, which increases gradually up to 700 C (during annealing for 1 hr at 700 C, an interlayer thickness of 3 cm is attained). At 800 C, the inter-layer quickly grows and simultaneously the structure of the coating becomes coarser. The effect of annealing time on the structure of the coating is similar but less pronounced. The composition of the atmosphere (air, hydrogen, nitrogen) during annealing and the composition of the base material do not influence the structure of the coating. Author

N71-21225 National Lending Library for Science and Technology, Boston Spa (England).
INVESTIGATION OF INTERNAL STRESSES OF ELECTROLYTICALLY DEPOSITED PALLADIUM-COBALT ALLOY
S. N. Vinogradov et al 6 Jul. 1970 3 p refs Transl. into ENGLISH from Zashch. Metal. (USSR), v. 5, no. 6, 1969 p 686-687 In ENGLISH and RUSSIAN
(NLL-Trans-746-512-(9022.401)) Avail: National Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The internal stress was measured using a flexible cathode, which was served by a copper plate measuring 50 x 10 x 0.1 mm, isolated from the non-working side by three layers of lacquer, with a deposit of the electrolytic alloy 3 microns thick. The porosity of the coating was determined by superimposing on the sample a filter paper, moistened by a solution of K3Fe(CN)6 10 g/1, NaCl 60 g/1 NH4C1 30 g/1. Electrolytic deposits of the alloy with decreased internal stresses were obtained when 0.5 g/1 saccharine was added to the electrolyte. The asymmetrical alternating current negligibly decreases the size of the internal stresses. Author

N71-21231 National Lending Library for Science and Technology, Boston Spa (England).
ACTIVITY OF TUNGSTEN SINTERING BY PLATINUM GROUP METALS
G. V. Samsonov et al 6 Jul. 1970 7 p refs Transl. into ENGLISH from Poroshkovaya Metall. (USSR), v. 10, no. 1, Jan. 1970 37-44 In ENGLISH and RUSSIAN
(NLL-Trans-746-540-(9022.401); NLL-LTI-737-7318) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The effect of additions of platinum group metals (Ru, Rh, Pd, Os) on tungsten sintering was investigated. Some data for these elements compared to tungsten are shown. It is evident that, in the direction from Ru to Pd, the statistical weight of atoms with the d(10)-configurations of electrons increases and the proportion of non-localized electrons decreases. The dependence of shrinkage, density, stability, microhardness and microstructure of tungsten moldings on the temperature of sintering and content of admixtures was investigated. The additions of ruthenium, rhodium, palladium and osmium were introduced into the tungsten powder in the amounts 0.05 to 1.0 wt %, Ru, Rh and Os being introduced in the form of mechanical admixtures and Pd in the form of aqueous PdCl2. The sintering was conducted in the temperature range of 1000 to 2000 C with a soaking of 1 hr at the given temperature. The properties of tungsten powder, the conditions of pressing, the technology of introducing admixtures and the systems of sintering are given. Author

N71-21232# Air Force Systems Command, Wright-Patterson AFB, Ohio.

PROTECTIVE ACTION OF OIL-SOLUBLE CORROSION INHIBITORS

L. N. Teterina et al 9 Oct. 1970 11 p refs Transl. into ENGLISH from Neftepererab. i Neftekhim. (USSR), no. 11, 1969 p 14–17

(AD-717011; FTD-HT-23-471-70) Avail: NTIS CSCL 11/6

The best synergistic effect was obtained by combining anodic, cathodic, and screening inhibitors, obtaining thus additives and preservative materials which provided, simultaneously, complete protection for ferrous and non-ferrous metals against corrosion for a long time. Protective efficiency and polarity of various corrosion inhibitors, protective properties of oil-soluble inhibitors, and some test results are tabulated. Author (GRA)

N71-21255# Los Alamos Scientific Lab., N.Mex.

ON THE QUESTION OF HIGH-PRESSURE SCALE

L. F. Vereshchagin et al 1970 9 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 191, 1970 p 557–560 Sponsored by AEC

(LA-tr-70-26) Avail: NTIS

Techniques for establishing a true scale of high pressures are described. The procedure is based on changes in electrical resistance with changes in pressure. The measured electrical properties are then calibrated against reference pressures in order to establish an accurate system for measuring pressures. NSA

N71-21262 National Lending Library for Science and Technology, Boston Spa (England).

X-RAY STUDY OF THE FINE STRUCTURE OF SUPERCONDUCTING ZIRCONIUM – 25 PERCENT NIOBIUM ALLOY

N. A. Sokolov et al 10 Aug. 1970 10 p refs Transl. into ENGLISH from Me alloved. Fiz.-Khim. i Metallofiz. Sverkhprovodnikovh (USSR) 1967 p 36–41

(NLL-CE-Trans-5329-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.

The change in structure of the Zr-25% Nb alloy was investigated during plastic deformation with reductions of from 0 to 94%, and also during annealing of the deformed alloy and the quenched alloy. An increase in critical current density occurs during all the above treatments. Thus, after annealing the deformed wire in the range 400 to 570 C the critical current density increases by 30 times, reaching 100,000 A/sq cm in fields of 30 koersted. After plastic deformation (with large degrees of reduction), the critical current density for this alloy is about 10,000 A/sq cm and, of the quenched alloy, an increase in critical current also occurs but to a lesser degree than after plastic deformation. Author

N71-21266 National Lending Library for Science and Technology, Boston Spa (England).

INVESTIGATION OF NONMETALLIC IMPURITIES IN INVAR AND SUPER- INVAR TYPE ALLOYS

I. A. Pavperova et al 21 Aug. 1970 2 p Transl. into ENGLISH from Sb. Tr. Tsent. Nauch.-Issled. Inst. Chern. Met. (USSR), no. 66, 1969 p 94–97 In ENGLISH and RUSSIAN

(NLL-Trans-746-633-(9022.401); NLL-LTI-734-4558) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

An iron-nickel Invar (36.0% Ni) and an iron-nickel-cobalt Super-Invar (32.0% Ni, 4.0% Co) were marked as experimental alloys 36 N (EP 474) and 32 NK (EP 475), respectively. The metal was melted in a crucible in a vacuum-induction furnace with a basic magnesite lining. All the melts were deoxidized by a nickel-magnesium alloy and calcium-silicide, except melt 4 which was deoxidized by metallic titanium. Alloy EP 475 was melted in refined Armco-iron. For the investigation of the deformed metal, ingots of two melts of alloy EP 474 and one melt of alloy EP 475 were rolled into bars 80 mm in diameter and two melts of alloy EP 475 55 mm in diameter. The content of nonmetallic inclusions was evaluated by two methods. Author

N71-21286 National Lending Library for Science and Technology, Boston Spa (England).

DISCUSSION OF POTENTIOKINETIC AND POTENTIOSTATIC MEASURING METHODS FOR USE IN CORROSION STUDIES

C. Herbsleb et al 10 Jul. 1970 16 p refs Transl. into ENGLISH from Corros. Sci. (England), v. 9, no. 8, 1969 p 615–629

(NLL-CE-Trans-5208-(9022.09) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The partial current-potential curves and the potentials at which the progress of a certain reaction ceases were studied to determine the critical limit potentials, which represent the protection potentials. It is shown in several practical examples that the only reliable measuring method for determination of critical potentials is a series of potentiostatic point-by-point measurements at stationary potentials combined, if necessary, with a gravimetric determination of the corrosion rate. Author

N71-21289# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EFFECT OF THE STATE OF METAL SURFACE ON ADSORPTION AND THE ACTION OF IRON CORROSION INHIBITORS

Z. A. Iofa et al 21 Aug. 1970 19 p refs Transl. into ENGLISH from Tr. Mezhdunar. Kongressa Korrozii Metallov (USSR), v. 2, 1968 p 38–46

(AD-717030; FTD-MT-24-167-70) Avail: NTIS CSCL 11/6

Recent investigations of the interfacial behavior of corrosion inhibitors are discussed and reviewed. The surface coverage by adsorbed particles was determined by conventional impedance measurements. Advances in the study of O and halide ion adsorption are considered. It is stressed that nonionic surface-active compounds are not adsorbed on an Fe surface, while organic anions are susceptible to adsorption. Corrosion tests provide evidence that Fe samples annealed at 600 degrees dissolve 2-3 times faster than if annealed at 750 degrees, even in the presence of inhibitors. Differential capacity and H overvoltage were determined at various stress values. A predominant orientation affects adsorption and electrochemical parameters. Annealing at given temps enhances a preferred orientation along the (211) and (220) axes with compact stacking and low adsorption. Author (TAB)

N71-21301# Salford Univ. (England). Dept. of Pure and Applied Physics.

STRUCTURE AND MAGNETIC PROPERTIES OF INTERNALLY OXIDIZED FERROMAGNETIC ALLOYS Final Scientific Report, Dec. 1967–Sep. 1970

R. Barlow, P. J. Grundy, P. J. Nolan, and R. S. Tebble 30 Sep. 1970 187 p refs

(Grant EOOAR-0005-68)

(AD-717210; AFOSR-70-2924-TR) Avail: NTIS CSCL 11/6

The aim of the work was to investigate the microstructure and magnetic properties of some internally oxidised ferromagnetic alloys. Such systems consist of a dispersion of fairly stable and inert oxide particles surrounded by a ferromagnetic metal matrix. Ideally they are suitable for use in the tests of theories of magnetic domain wall--precipitate interaction coercivity and for use as mechanically stabilised soft ferromagnetic material in high temperature applications. Author (GRA)

N71-21307 National Lending Library for Science and Technology, Boston Spa (England).

MECHANISMS OF MELTING METALS. COMMUNICATION 1

Y. S. Nechaev 24 Aug. 1970 4 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Cher. Met. (USSR), v. 13, no. 1, 1970 p 124–127 In ENGLISH and RUSSIAN
(NLL-Trans;746-560-(9022.401); NLL-LTI-737-7389) Avail: Natl. Lending Library, Boston, Spa, Engl.: 1 NLL photocopy coupon

The mechanism of the transfer from long- to short-range atomic ordering in liquid metals was investigated. Since the possibility of the vacancy mechanism of melting is conclusively based on thermodynamics, it was considered expedient to investigate this question from the kinetic point of view in comparison with experimental material concerning the structure and properties of solid and liquid metals, particularly with the data obtained concerning the kinetics of melting aluminum and copper. Author

N71-21309# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EFFECT OF COMPOSITION AND HEAT TREATMENT ON WEAR RESISTANCE AND FATIGUE STRENGTH OF MEDIUM CARBON STEEL

I. G. Uzlov et al 2 Sep. 1970 8 p Transl. into ENGLISH from Nauchn. Tr. Inst. Chernoi Met. (Dnepropetrovsk), no. 30, 1969 p 120–122
(AD-717055; FTD-HT-23-451-70) Avail: NTIS CSCL 11/6

Two given heat treated medium-carbon steels were treated to reach the hardness 200, 250, 300, 350, 400, and 450 HB by the following procedures: (1) hardening initially in water and finishing in oil to obtain a martensite structure, and (2) isothermal hardening. High wear resistance, when hardened by (1) was shown only by specimens with hardness 350-400 HB. However, when the (2) was used, at conditions which gave lamellar structure of carbides, such a steel showed high wear resistance at all levels of hardness, 250-450 HB. The best wear resistance was shown by the steel containing C 0.62 percent with a mixt. of ferrite and cementite with lamellar carbides. The fatigue strength can be made higher by increasing the C concentration and hardness. Author (GRA)

N71-21383 National Lending Library for Science and Technology, Boston Spa (England).

KINETICS OF THE ANODIC PASSIVATION OF IRON, COBALT, AND NICKEL. 2: STUDY OF THE PASSIVATION OF NICKEL IN SULPHURIC ACID AND PERCHLORIC ACID USING A ROTATING DISC ELECTRODE

U. Ebersbach et al 18 Aug. 1970 11 p refs Transl. into ENGLISH from Electrochimica Acta (England), v. 14, no. 8, Aug. 1969 p 773–781
(NLL-CE-Trans-5359-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.

Anodic current density-time curves at constant potential on a rotating nickel electrode in M/2 sulfuric acid and 1 m perchloric acid show no dependence of the rate of passivation upon the velocity of stirring or the solubility of the nickel salts, which is dependent upon the primary formation of a salt layer during passivation. The current density falls at constant potential in the passivation region exponentially with the time, and the slope of the log i/t straight lines increases exponentially with potential. Both dependences can be explained in terms of the occurrence of active dissolution at the same time at the passivating reactions and give for the passivation process the electron discharge number 2. Author

N71-21384 California Univ., Berkeley.

THE VISCOSITY OF URANIUM METAL AND SOME URANIUM-CHROMIUM ALLOYS

James Single Finucane (Ph.D. Thesis) 1969 51 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 70-6100

An oscillating crucible viscometer capable of precise viscosity determinations above 1000 C was constructed. The operating details were developed and the viscosity of uranium metal and two uranium-chromium alloys was measured. Dissert. Abstr.

N71-21391# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MECHANICAL TESTING OF METALS AT HIGH TEMPERATURES AND SHORT TERM LOADING [MEKHANICHESKIE ISPYTANIYA METALLOV PRI VYSOKIKH TEMPERATURAKH I KRATKOVREMENNOM NAGRUZHENII]

N. P. Ageev et al 23 Oct. 1970 291 p refs Transl. into ENGLISH from the Russian
(AD-716937; FTD-HC-23-424-69) Avail: NTIS CSCL 11/6

Methods of mechanical metal testing at high temperatures and short-term loading and the influence of temperature and deformation rates on deformation resistance, hardenability, and plasticity are discussed. Data on machines used for testing, loading, registering deformation parameters, and methods of preparing, conducting, and processing test results are presented. The mechanical properties of a series of metals obtained by the methods reviewed, which may be useful for technical calculations, are included. GRA

N71-21394# California Inst. of Tech., Pasadena. U. M. Keck Lab. of Engineering Materials.

RADIAL DISTRIBUTION FUNCTION OF AN AMORPHOUS Mn-P-C ALLOY

Ashok K. Sinha and Pol Duwez Jan. 1971 14 p refs
(Contract AT(04-3)-822)
(CALT-822-21; Rept-16) Avail: NTIS

An amorphous manganese base alloy having the composition Mn 75%, P 15%, and C 10% was synthesized by rapid quenching from the liquid state. Its structure was studied using X-ray diffraction. The interference function of this alloy is characterized by a shoulder on the high-angle side of the second peak, a feature which was previously observed in several other amorphous alloys but not in amorphous Ni-Pt-P and metallic liquids. Both the atomic distribution function and the radial distribution function contain a split double-peak beyond the first maximum. The radius of the first near neighbor shell is 2.63 A, and its coordination number is approximately 12. The ratio of second to first near neighbor interactomic distances is equal to 1.7, a value significantly smaller than that observed in metallic liquids. A structural model based upon dense-random-packing of Mn atoms with the metalloids P and C filling up some of the interstices may be appropriate for this alloy. Author

N71-21405# Oak Ridge National Lab., Tenn.

CORROSION TESTS ON VARIOUS MATERIALS IN SEAWATER UP TO 150 C

G. Boisde et al Dec. 1970 13 p refs Transl. into ENGLISH from Proceeding of 3d Intern. Symp. on Fresh Water From the Sea, Vol. 1 (Dubrovnik), 13–17 Sep. 1970 p 570–590 Sponsored by AEC
(ORNL-tr-2412; CONF-700926-2) Avail: NTIS

The behavior of materials such as titanium, austenitic stainless steels, chromium ferrites, and light alloys was investigated in flowing natural sea water. The investigations lead to the following conclusions: (1) The oxygen content of sea water plays a leading part in the corrosion processes of the materials which were studied. This influence is particularly evident on the formation of pits on austenitic stainless steels and aluminum alloys. (2) The rising of temperature increases the damage caused by pitting on aluminum alloys; it also increases the risk of transgranular cracking for austenitic stainless steels, as well as the tendency to localized corrosion of chromium ferrites. (3) Under static conditions, in synthetic aerated sea water at 150 C, the presence of crevice could induce a rather important attack on some copper alloys. Author

N71-21406# Oak Ridge National Lab., Tenn.
STRUCTURAL STABILITY OF AUSTENITIC Cr-Ni STAINLESS STEELS TO DEFORMATION AND EXTREMELY LOW TEMPERATURE
P. Rousseau et al 1970 44 p refs Transl. into ENGLISH from Mem. Sci. Rev. Met. (Paris), v. 67, 1970 p 315–334 Presented at the Autumn Met. Meetings, Paris, 6–10 Oct. 1969 Sponsored by AEC
(ORNL-tr-2314) Avail: NTIS

Three industrial austenitic stainless steels with 0.05% C, 18% Cr, and a variable content of nickel (12.6, 8.3 and 7.4%) were studied. In these steels, the structural transformations induced by simple cooling to low temperature (down to liquid helium) or by plastic deformation at room temperature (tensile stress) were examined. The nature, morphology and crystallography of the products of transformation (deformation twins, compact hexagonal epsilon martensite, body-centered cubic alpha prime martensite) could be identified by X-ray observations and with optical electron microscopes. An analysis of the mechanisms of formation of the phases epsilon and alpha prime was worked out from these, and a scheme of the overall behavior of austenitic stainless steels in regard to plastic deformation and cooling to low temperature is proposed. Author

N71-21436# Oak Ridge National Lab., Tenn.
ALUMINUM ALLOYS IN SEA WATER DESALINATION INSTALLATIONS
C. Vargel et al Dec. 1970 16 p refs Transl. into ENGLISH from Proceedings of 3d Intern. Symp. on Fresh Water from the Sea, Vol. 1 (Dubrovnik), 13–17 Sep. 1970 p 501–515 Sponsored by AEC
(ORNL-tr-2413; CONF-700926-4) Avail: NTIS

The replacement of copper-bearing alloys with aluminum alloys in distillation desalination plants is discussed. A large test loop which contains light alloy heat exchangers is described for long term testing of alloy behavior. The results of various clad and unclad alloy tests with pH control treated sea water between 20 and 120 C are evaluated. J.M.

N71-21437*# Battelle Memorial Inst., Columbus, Ohio.
MECHANICAL PROPERTIES AND LOX COMPATIBILITY OF STAINLESS STEEL-CLAD TITANIUM PREPARED BY EXPLOSIVE WELDING AND VACUUM DEPOSITION Final Report
K. E. Meiners 31 Dec. 1969 108 p
(Contract NAS3-12007)
(NASA-CR-72841) Avail: NTIS CSCL 11F

Explosive welding and physical vapor deposition were investigated as candidate techniques for production of the bilaminate composite, Type 304 L stainless steel/Ti-5Al-2.5Sn (ELI grade). Clad 0.5 in. plate and 0.050 in. sheet were prepared by explosive welding. Physical vapor deposition was employed to prepare sheet clad with 0.0001 to 0.010 in. of stainless steel. Drop-weight impact in the presence of liquid oxygen (LOX) was used to demonstrate the protection offered by a thin stainless cladding against titanium-LOX reaction under a variety of impact situations. cladding thicknesses, and intentional defect sizes. Fatigue, tensile, and fracture-toughness properties of the products of both fabrication methods were determined at ambient and cryogenic temperatures. Author

N71-21438 Ohio State Univ., Columbus.
THE ELECTRODE KINETIC BEHAVIOR OF NICKEL IN DILUTE ACID SOLUTIONS FROM 25 C TO 300 C
Robert Lee Cowan, II (Ph.D. Thesis) 1969 173 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 70-8751

The effect of temperature upon the electrode kinetics of nickel in the 25 C to 300 C temperature range in dilute acid solutions was investigated. The kinetic behavior was studied in solutions of pH 1.3 (0.05N H_2SO_4 + 0.05N K_2SO_4), pH 3.4(0.001N H_2SO_4 + 0.099N K_2SO_4) and pH 6.3 (0.10N K_2SO_4). Potentiokinetic polarization curves were determined in the anodic direction (both active to noble and noble to active scan modes) and the cathodic direction. In addition, potentiostatic current-time behavior and potential decay behavior were determined at selected temperatures and pH. Scanning electron microscopy was also employed to observe the surface topology of nickel dissolution at different potentials, pH and temperatures. Theoretical potential-pH diagrams were constructed for the nickel-water system at temperatures of 25 C, 60 C, 100 C, 150 C, 200 C, 250 C, and 300 C by employing the correspondence principle of ionic entropies. Dissert. Abstr.

N71-21439# Maryland Univ., College Park. Coll. of Engineering.
DYNAMIC MICROPLASTICITY OF BCC METALS AND SOLID SOLUTIONS
R. J. Arsenault, C. R. Crowe, and R. D. Carnahan (University Oil Prod. Co.) May 1970 47 p refs Presented at 3d Intern. Symp. on Pure Mater. in Sci. and Technol., Dresden
(Contract AT(40-1)-3612)
(CONF-700545-1) Avail: NTIS

Significant plastic deformation can occur at low stresses in metals exhibiting a large Peierls' stress. The plastic strain can be accounted for by the difference in Peierls' stresses of an edge and screw dislocation which can be readily calculated. The presence of interstitial impurities does indeed affect the amount of microstrain observed and for cases where these impurities are regarded as controlling macroscopic deformation the amount of microstrain observed is generally less than 0.000001. It is possible, by studying the dynamic microplastic behavior of BCC metals and alloys, to determine whether the instrinsic lattice or impurities provide the barrier to dislocation motion. As a result of studies of the dynamic activated parameters for these materials in the microplastic region, it is concluded that overcoming the intrinsic lattice resistance is the rate controlling step in thermally activated dislocation motion. Author

N71-21441 California Univ., Berkeley.
FRACTURE TOUGHNESS OF PRECIPITATION HARDENING ALUMINUM ALLOYS
David Eugene Porter (Ph.D. Thesis) 1969 138 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 70-8192

The mechanical properties of five high purity aluminum-zinc alloys (7 to 50% Zn) and four high purity aluminum-silver alloys (5 to 30% Ag) were investigated. Emphasis was placed on intergranular fracture. The properties were correlated with the microstructure and fractographic observations. There were two basic intergrannular fracture processes, a slow and a fast-crack growth process. Slow-crack growth occurred by microvoid coalescence, leaving a dull fracture surface. Fast-crack growth leaves a bright featureless surface. Of the alloys studied, only the aluminum-zinc alloys with 25% zinc or more in the maximum strength condition were found to fracture by a fast-crack growth process. The calculated value of the stress intensity factor for slow-crack growth, based on the energy dissipated in the plastic zone, was consistent with the measured value. Dissert. Abstr.

N71-21478 National Lending Library for Science and Technology, Boston Spa (England).
THE EFFECT OF COLD WORKING ON THE CREEP OF THE AUSTENITIC STEEL X 6 Cr NI 189 AT ROOM TEMPERATURE
W. Schmidt 15 Jul. 1970 30 p ref Transl. into ENGLISH from Draht Welt (Coburg), v. 55, no. 11, 1969 p 670–678
(NLL-CE-TRANS-5413-(9022.09)) Avail: Natl. Lending Library,

Boston Spa, Engl.: 3 NLL photocopy coupons

The dependance of the creep properties of the austenitic steel X 5 CrNi 189 on previous cold working is investigated. Elongation of cylindrical specimens with treaded ends are measured on a tensile testing machine with electronic measurement of load and displacement. Experimental results and consequences for the use of this steel in practice are discussed. Author

N71-21494 National Lending Library for Science and Technology, Boston Spa (England).

KINETICS OF BORON PLATING AND ITS EFFECT ON MECHANICAL PROPERTIES OF NICKEL

Y. V. Levinskii et al 3 Jul. 1970 4 p refs Transl. into ENGLISH from Poroshkovaya Metall. (USSR), v. 9, no. 12, Dec. 1969 p 46–50 In ENGLISH and RUSSIAN

(NLL-Trans-746-493-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

While investigating the kinetics of boron plating from the gase phase at 900 C, a linear dependence between the width of the layer and time was discovered. This character of the growth of the boride layer is explained by fluctuations of concentration which lead to a local increase of temperature and formation of an easily melted eutectic. Author

N71-21495 National Lending Library for Science and Technology, Boston Spa (England).

DISTRIBUTION OF COMPONENTS BETWEEN ALPHA AND GAMMA PHASES AT ALPHA TO GAMMA CONVERSION IN IRON NICKEL ALLOYS

V. I. Zeldovich et al 6 Jul. 1970 8 p refs Transl. into ENGLISH from Fiz. Metallov Metalloved. (USSR), v. 28, no. 4, 1969 715–722 In ENGLISH and RUSSIAN

(NLL-Trans-746-538-(9022.401); NLL-LTI-737-6838) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The distribution of components between alpha and gamma phases at the alpha to gamma conversion, taking place during isothermal soaking in the temperature range of the double-phase (alpha + gamma)-area of the metastable diagram of iron-nickel alloys was investigated. It was established that the preliminary plastic deformation has a strong effect on the course of distribution during the alpha to gamma conversion. In the deformed 28Ni alloy, in which a reverse martensitic transfer takes place, the alpha to gamma conversion takes place with an exchange of components between the alpha and gamma phases even during short isothermal soakings. The distribution of iron and nickel during the alpha to gamma conversion under conditions of continuous heating at a low rate leads to the stabilization of the austenite in relation to the gamma to alpha conversion. Author

N71-21496 National Lending Library for Science and Technology, Boston Spa (England).

ELECTRODEPOSITION OF Cu-Ni ALLOYS FROM PYROPHOSPHATE ELECTROLYTES

N. Y. Fedotova et al 3 Jul. 1970 7 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Tsvet. Metall. (USSR), v. 3, no. 3, 1960 p 151–154 In ENGLISH and RUSSIAN

(NLL-Trans-746.499-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A technique for electrodepositing Cu-Ni alloys from pyrophosphate electrolytes is reported. The electrolyte base is potassium pyrophosphate which allows a metal concentration of up to 1 g-equivalent/1 because of potassium salt solubility. Results show that the discharge of the alloy increases with the relative copper concentration in the solution and that quality coatings with a 70% nickel content are obtained. G.G.

N71-21497 National Lending Library for Science and Technology, Boston Spa (England).

DENTRITIC LIQUEFACTION IN Fe ALLOYS

A. I. Yatsenko et al 6 Jul. 1970 4 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Metally (USSR), no. 6, 1969 p 73–78 In ENGLISH and RUSSIAN

(NLL-Trans-746-510-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

During the crystallization of alpha (delta) or gamma-solid solution in alloyed iron-carbon alloys, a direct or reverse liquefaction of the alloyed elements is possible. The reverse liquefaction is characteristic for elements, easily soluble in the austenite and increasing the thermodynamic activity of carbon. When one of these conditions is not satisfied, the liquefaction is direct. Some characteristics of the liquefaction of nickel, copper, silicon and molybdenum in alloys with different carbon contents were investigated. Author

N71-21498 National Lending Library for Science and Technology, Boston Spa (England).

CORROSION PROPERTIES OF ELECTRODEPOSITS ZINC AND CADMIUM ALLOYS

A. B. Livshits et al 3 Jul. 1970 4 p refs Transl. into ENGLISH from Zashch. Metal. (USSR), v. 5, no. 6, 1969 p 643–646 In ENGLISH and RUSSIAN

(NLL-Trans-746-490-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The corrosion resistance of 6 binary zinc and cadmium alloys in different corrosive media and under conditions of contact with stainless steel and an aluminum alloy was studied. An alloy containing 80% cadmium and 20% tin possesses the best protective properties. It is recommended that cadmium-tin coatings should be applied instead of zinc and cadmium coatings for corrosion protection of components subjected to marine or industrial conditions. The zones of contact of the cadmium-tin alloy with stainless steel do not require supplementary protection. Author

N71-21499 National Lending Library for Science and Technology, Boston Spa (England).

INDUSTRIAL SOFT MAGNETIC MATERIALS BASED ON NICKEL IRON

F. Assmus 22 Sep. 1970 25 p refs Transl. into ENGLISH from Arch. Tech. Messen. (Munich), no. 393/394, Oct./Nov. 1968 p 227–232 and 253–256

(NLL-Trans-2654-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.

Metallurgical and physical properties of nickel iron alloys are discussed and it is shown that their crystal energy constants and soft magnetic properties are determined by the manufacturing process up to the finished heat treatment stage. Alloys in the 47 to 50% nickel range possess maximum saturation with important permeability properties at medium field strengths. They are used in laminated magnetic cores and shaped parts of greater thickness for high sensitivity relays and soft iron measuring systems. Alloys with 70 to 80% nickel show the lowest coercive force of all known rectangular loop materials. G.G.

N71-21519# Royal Aircraft Establishment, Farnborough (England).

THE RELATIONSHIP BETWEEN STRESS-STRAIN CURVES AND DERIVED PARAMETERS FOR DUCTILE METALS [ZUSAMMENHANG ZWISCHEN FLIESSKURVE UND WERKSTOFFKENNWERTEN BILDSAMER METALLISCHER WERKSTOFFE]

W. Panknin et al Dec. 1970 23 p refs Transl. into ENGLISH from Z. Metallk. (Stuttgart), v. 52, no. 7, 1961 p 455–461

(RAE-Lib-Trans-1491) Avail: NTIS

The deformation behavior of commercial alloys was studied in order to formulate the stress-strain relationship in the plastic range. Two exponential functions for this relationship, which have been found to fit reasonably well the experimental test results for

most common metals, are dealt with, and expressions for the relevant exponents of the two functions have been derived, e.g. tensile strength, strain hardening rate, relative strain hardening and strain energy. Fairly close agreement for the tensile strength is shown to exist between the calculated and the measured values for a number of ferrous and non-ferrous metals tested in sheet form. Author

N71-21571 Vanderbilt Univ., Nashville, Tenn.
X-RAY DIFFRACTION STUDIES OF TRANSFORMATION INDUCED IMPERFECTIONS IN FERROUS MARTENSITES
Dilip Kumar Chaudhuri (Ph.D. Thesis) 1969 147 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 70-5391

X-ray line broadening analysis of the line imperfections (dislocations), planar disorders (stacking and twin faults) and microstrains induced by the martensitic transformation in iron-nickel and iron-carbon alloys was made using both the Warren – Averbach multiple-order method and the Rothman – Cohen method, for which a computer program was developed. Comparison of the results obtained by the two methods indicates that the latter method can be used when analysis by the multiple-order method is not possible, provided the stress state of the material is known. Dissert. Abstr.

N71-21582# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
KONDO TEMPERATURE AND UNITARITY LIMIT IN NON-DILUTE MAGNETIC AMORPHOUS ALLOYS
V. K. C. Liang and C. C. Tsuei Jan. 1971 11 p refs *Its* AEC Res. and Develop. Rept. No. 15
(Contract AT(04-3)-822)
(CALT-822-20) Avail: NTIS

The results of electrical resistivity versus temperature measurements on an amorphous alloy Ni41Pd41B18 (henceforth denoted by (B)) containing up to 4 at.% Cr are given. The resistivity data are fitted with Hamann's theory to obtain the values of the unitary limit and of the Kondo temperature. A simple theory based on the interaction between the polarization clouds around the magnetic atoms is proposed to interpret the concentration dependence of unitary limit and Kondo temperature. Contrary to what was found in most crystalline Kondo alloys a relatively large concentration of a magnetic impurity can be introduced in amorphous alloys without quenching the logarithmic temperature dependence of resistivity. The absence of long range order in the atomic arrangement and the reduced d-d exchange interaction are expected to facilitate the study of the s-d exchange interaction in a metal, with a minimum extraneous influence of crystal structure effects Author

N71-21587*# Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy and Materials Science.
RESEARCH ON MECHANISMS OF ALLOY STRENGTHENING. 1: STRENGTHENING THROUGH FINE PARTICLE DISPERSION. 2: CONTROL OF STRUCTURE AND PROPERTIES BY MEANS OF RAPID QUENCHING OF LIQUID METALS (SPLAT COOLING) Semiannual Report
Nicholas J. Grant Jan. 1971 15 p
(Grant NGL-22-009-003)
(NASA-CR-117502) Avail: NTIS CSCL 11F

Tension properties, electromagnetic transmission, and stress-rupture properties of extruded solid solution strengthened nickel-base alloys containing aluminum from 1 to 6 weight percents are discussed. Extrusion variables for nickel-base beryllium oxide alloys and titanium carbide alloys are discussed as well as the results of tension and stress-rupture tests and thermo-mechanical treatment effects on creep rupture properties. Fatigue, tensile, and stress-rupture properties are summarized for splat cooled aluminum alloys including silicon, copper, and iron alloys. J.M.

N71-21588 Virginia Polytechnic Inst., Blacksburg.
X-RAY DIFFRACTION INVESTIGATION OF BIMETALLIC DIFFUSION ZONES IN THE Cu-Au AND Cu-Ni SYSTEMS
Darrel Ray Tenney (Ph.D. Thesis) 1969 211 p
Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00 Order No. 70-5366

A nondestructive X-ray diffraction technique was developed for the measurement of the composition profiles and the crystal structures that exist along small diffusion zones, extending roughly from one to ten microns. The technique was applied to the diffusion of Ni and Au electroplatings into single crystals of Cu having a (111) orientation. After a high-temperature diffusion treatment, intensity bands were formed which were continuous for the Cu-Ni alloy system and discontinuous for the Cu-Au alloy system. Quantitative intensity measurements were made on the (222), (333), (444) and (555) bands. Crystal misorientation, at each composition along the diffusion zones, was obtained from rocking curves. In both the Cu-Ni and the Cu-Au alloy system, diffusion resulted in significantly altering the misorientation of the material in the diffusion zone. Dissert. Abstr.

N71-21589*# Battelle Memorial Inst., Columbus, Ohio. Metal Science Group.
STRUCTURAL STABILITY AND MECHANICAL BEHAVIOR OF THERMOMECHANICALLY PROCESSED DISPERSION STRENGTHENED NICKEL ALLOYS Final Report
B. A. Wilcox, A. H. Clauer, and W. B. Hutchinson (Birmingham Univ.) 18 Mar. 1971 158 p refs
(Contract NAS3-11167)
(NASA-CR-72832) Avail: NTIS CSCL 11F

Thermomechanical processing of dispersion-strengthened and dispersion-free Ni-base alloys was found to influence the microstructure, crystallographic texture, and strength. The alloys studied included: Ni, Ni-2ThO2, Ni-20Cr, Ni-20Cr-2ThO2, Ni-20Cr-10W, and Ni-20CR-10W-2ThO2. It is concluded that refining the substructure is a much more potent means of strengthening at room temperature than is dispersion hardening. The major microstructural feature which affected high temperature strength was the grain aspect ratio, i.e., grain length divided by grain width. The yield strength and creep strength at 1093 C increased linearly with increasing grain aspect ratio. The role of deformation texture in recrystallization resistance and in development of microstructures during recrystallization is discussed. Author

N71-21594 California Univ., Riverside.
NUCLEAR MAGNETIC RESONANCE IN DILUTE INDIUM-CADMIUM INDIUM-MERCURY AND INDIUM-THALLIUM ALLOYS
Frederick Clarence Thatcher (Ph.D. Thesis) 1969 124 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 70-6372

Measurements were made of the isotropic Knight shift, anisotropic Knight shift, quadrupole coupling frequency, and line widths of the In-115 nuclear resonance as a function of solute concentration to 4.7 at. % Cd, 4.3 at. % Hg, and 7.9 at. % Tl. A theory was developed for line widths and line shapes in dilute indium alloys. The quadrupole coupling was found to depend strongly on the c/a ratio, and weakly on the atomic volume and impurity scattering. The enhancement factor of Kohn and Vosko was determined to be 85 + or – 15. The isotropic Knight shift exhibited a dip similar to that previously observed in I-Sn and In-Pb. It is proposed that the isotropic Kinght shift behavior in the dilute region is due to averaging of anisotropic electron-electron interactions as a result of impurity scattering. Dissert. Abstr.

N71-21595*# Oak Ridge National Lab., Tenn.
COMPARISON OF CALCULATED AND MEASURED LOWER CRITICAL FIELD FOR SOME Nb-Ti ALLOYS
M. S. Lubell and R. H. Kernohan Oct. 1970 24 p refs Submitted for publication ponsored in part by NASA and AEC
(NASA-CR-117493; ORNL-TM-3206) Avail: NTIS CSCL 11F

An expression is obtained from the Maki theory for the lower critical field (0) in terms of three measurable material constants transition temperature, normal state resistivity, and the nonparamagnetically limited GLAG upper critical field. The calculations are compared to the measured lower critical field extrapolated to T = 0 K for three vacuum annealed Nb-Ti alloys. Values of lower critical field (0) are also determined from the computation of Harden and Arp. Both sets of calculated values differ greatly from the measured values showing that the Maki theory is not applicable for kappa sub GL < 30, and the computation of Harden and Arp is not valid at T = 0 K in disgreement with recent results of Echarri et al. Analysis of data available in the literature supports the conclusions. Comparison of the magnetization data near transition temperature with the theory of Neumann and Tewordt shows reasonable agreement. Author (NSA)

N71-21602 National Lending Library for Science and Technology, Boston Spa (England).
THE EFFECT OF DOPING WITH SILVER ON DISCONTINUOUS PRECIPITATION IN LEAD SODIUM SOLID SOLUTIONS
K. Meeder and E. Hornbogen 10 Jul. 1970 16 p refs Transl. into ENGLISH from Z. Metallk. (Stuttgart), v. 60, no. 5, May 1969 p 475 481
(NLL-CE-TRANS-5252-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The precipitation behavior of lead-10 at% Na, and of the same alloy with 0.045 and 0.145 at% Ag, is investigated between 20 and +100 C using optical microscopy and electron microscopy (surface replicas). There are no differences between the alloys as regards the growth of the continuous coherent precipitates. The initial velocities of the discontinuous precipitation between 10 to the minus 7th power and 10 to the minus 4th power cm/sec and depend on the structure of the reaction front. The addition of silver reduces the velocities by a factor of up to 10 compared with those in the undoped alloy. Three states of segregation, and thus three velocity ranges, are possible for the various grain boundaries. The results are interpreted qualitatively using an atomistic grain boundary model in analogy to recrystallization. Author

N71-21603 National Lending Library for Science and Technology, Boston Spa (England).
SOME CHARACTERISTICS OF THE HIGH TEMPERATURE CREEP OF TWO PHASE ALLOYS
K. K. Ziling et al 30 Jul. 1970 7 p refs Transl. into ENGLISH from Izv. VUZ. Fiz. (USSR), no. 11, 1968 p 157 160
(NLL-CE-Trans-5438-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The contribution of diffusion-viscous flow, as described by Nabarro and Herring, to the high temperature creep of a copper-aluminum alloy after internal oxidation, is investigated. Conclusions indicate that the mechanism can be effectively retarded if finely dispersed particles of the second phase are present at the boundaries. Author

N71-21604 National Lending Library for Science and Technology, Boston Spa (England).
EFFECT OF SMALL AMOUNT OF ALLOYING ELEMENTS ON STRUCTURE AND STABILITY OF BORONIZED MEDIUM CARBON STEEL
V. G. Protsik et al 6 Jul. 1970 4 p refs Transl. into ENGLISH from Fiz.-Khim. Mekh. Mater. (Ukrainia SSR), v. 5, no. 6, 1969 p 661 665 In ENGLISH and RUSSIAN
(NLL-Trans-746-527-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The effect of a small amount of alloying elements - Mn, Si, Ni, Cr - on the structure and mechanical properties of medium carbon steel after boronization was investigated. It was shown that, with an increase of alloying element in the steel, the tensile strength increases, and the plasticity and impact strength decrease. Boronization of low carbon steels accentuates the change of these properties, however, the elements investigated affect each characteristic differently. Author

N71-21605# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
OXIDATION OF REFRACTORY METALS IN THE PRESENCE OF ALKALI CATIONS
Gary Geschwind Mar. 1971 80 p refs
(RE-405) Avail: NTIS

Oxidation of the refractory metals, tantalum, niobium, and tungsten, with and without the presence of alkali metal compounds, was studied by differential thermal and analysis (DTA) and thermogravimetric analysis (TGA). Oxidation kinetics of uncoated 20 mil thick tantalum and tungsten and 60 mil thick niobium sheets were similar to previous work. Oxidation kinetics of 20 mil thick niobium was parabolic in contrast to previously reported linear behavior. The presence of lithium in the alkali metal compound was found to be the most effective alkali metal in retarding the oxidation of tantalum and niobium at temperatures between 800 C and 1000 C, in that its presence resulted in an extended period of no weight gain. The presence of lithium and potassium in conjunction with tungsten gave rise to a reduction in the rate of weight gain and a change in kinetics from parabolic to cubic at temperatures between 900 C and 1200 C. Author

N71-21606*# Denver Univ., Colo.
A STUDY OF METAL OXYGEN AND METAL NITROGEN SYSTEMS FOR USE AS REDUCED PRESSURE STANDARDS
Charles E. Lundin 1971 20 p refs
(Contract NAS1-9236)
(NASA-CR-111862) Avail: NTIS CSCL 11F

A series of metal-oxygen and metal-nitrogen binary systems were surveyed to determine their potential as sources for secondary reduced pressure gas standards. The respective gases of interest were nitrogen and oxygen, which were studied independently. The technique employed was to measure the equilibrium reduced pressure of the gas in a static, closed system, otherwise evacuated of other gases, over a metal-gas alloy at each of a succession of temperature levels. Those systems found to demonstrate a first order equation representing the log of pressure versus reciprocal absolute temperature were studied extensively. Ten metal-oxygen systems and thirteen metal-nitrogen systems were surveyed. None of the metal-oxygen systems was found to be applicable, whereas two metal-nitrogen systems demonstrated feasibility. These were the Ba-N and Zr-N systems. Statistical analyses of the fit of the respective data were conducted. Author

N71-21616# Stanford Univ., Calif. Dept. of Materials Science.
STRUCTURE DEPENDENCE OF HIGH TEMPERATURE DEFORMATION OF METALS Progress Report, 1 Mar. 1969 1 Mar. 1970
William D. Nix and Craig R. Barrett 1 Mar. 1970 44 p refs
(Contract AT(04-3)-326)
(SU-326-P-17-X-1) Avail: NTIS

Progress in a research program concerned with the structure dependence of high temperature deformation of metals and alloys is summarized. Work toward development of a deeper understanting of the relation between structure and high-temperature creep and

creep rupture of metals is described along with work on new ways of improving the creep resistance of metals through structural control. An extensive portion of the study was concerned with determining the rate controlling creep mechanism operating in metals and alloys at very high temperatures and low stresses. NSA

N71-21700# California Univ., Berkeley. Lawrence Radiation Lab.
SHEAR STRENGTH OF BERYLLIUM, URANIUM, AND TUNGSTEN AS A FUNCTION OF STRAIN, STRAIN RATE, AND PRESSURE
A. E. Abey and H. D. Stromberg 22 May 1970 23 p refs Presented at the ASME Winter Annual Meeting, New York, 30 Nov.–3 Dec. 1970 Supported by AEC
(UCRL-72477; CONF-701110-1) Avail: NTIS

The shear strengths of beryllium, uranium, and tungsten were measured at strain rates of 3.5 × 0.00001, 3.6 × 0.001 and 3.7 × 0.1/sec. The measurements were taken under nearly hydrostatic pressures of 21, 44, and 63 × 10 to the 8th power N/m sq m. The shear strength vs shear strain curves are presented along with the pressure and in strain rate derivatives of the experimental parameters. Author (NSA)

N71-21709 National Lending Library for Science and Technology, Boston Spa (England).
STUDY OF CORROSION RESISTANT TITANIUM BASE UNDER PLATINUM COATING DEPENDING ON pH OF ANOLYTE
S. D. Khodkevich et al 24 Aug. 1970 5 p refs Transl. into ENGLISH from Elektrokhimiya (USSR), v. 6, no. 1, Jan. 1970 p 135–138 In ENGLISH and RUSSIAN
(NLL-Trans-748-561-(9022.401); NLL-LTI-737-7478) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The results of a study of the electrochemical and corrosion behavior of a titanium base under a platinum coating in pH range of 0 to 14 are given. The experiments were carried out in solutions of alkalis in concentrations ranging from 0.1 to 10.0 N and in a wide range of concentrations of salt and sulfhuric acids. No information is available for the alkaline carbonate electrolytes. Author

N71-21719# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
SODIUM TECHNOLOGY DEVELOPMENT PROGRAM MASS TRANSFER INVESTIGATIONS IN LIQUID METAL SYSTEMS Quarterly Progress Report, Mar. – May 1970
Jun. 1970 45 p refs
(Contract AT(04-3)-189)
(GEAP-13539-13; QPR-13) Avail: NTIS

Improvements of empirical and rational models for use in predicting corrosion and mass transfer in Na systems are summarized. Work is also reported on improved sampling and monitoring systems for Na systems. Results of investigations on the integrity of LMFBR materials such as Types 304 and 316 stainless steels are reported. NSA

N71-21735# Bettis Atomic Power Lab., Pittsburgh, Pa.
INFLUENCE OF PRIOR CORROSION HISTORY UPON THE HYDROGEN PICKUP BY ZIRCALOY DURING SUBSEQUENT EXPOSURE IN HOT WATER
Stanley Kass Dec. 1970 34 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-906) Avail: NTIS

The influence of prior corrosion history upon the aqueous corrosion and hydrogen absorption characteristics of Zircaloy was studied. These experiments confirmed prior studies describing the aqueous corrosion behavior of Zircaloy containing oxide films formed at temperatures different from that of the final exposure. A 1-day, 750 F, 1500-psi steam corrosion test before exposure to hot pressurized water produced measurably lower hydrogen pickup values during the pre- and post-transition corrosion region. Any prior water-formed film prevented the beneficial effect the subsequent 750 F treatment upon hydrogen absorption. The post-transition hydriding rates also were found not to be measurably altered by prior corrosion treatments involving water-plus-steam exposure. Author (NSA)

N71-21789# Oak Ridge National Lab., Tenn.
VOIDS IN NEUTRON IRRADIATED ALUMINUM
Nicolas Hayes Packan (Ph.D. Thesis–Missouri Univ.) Jan. 1971 155 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3109) Avail: NTIS

Void formation in high-purity aluminum resulting from irradiation to fluences between 1.5 × 10 to the 19th power and 1.6 × 10 to the 22nd power neutrons/sq cm (E > 0.1 MeV) at a temperature of 55 + or – 5 C was studied, primarily by means of transmission electron microscopy. In particular the effects of neutron fluence and flux were examined, as well as the possible influences of both preexisting and transmutation-produced impurities. Author (NSA)

N71-21790# Westinghouse Electric Co., Pittsburgh, Pa. PWR Systems Div.
HEAVY SECTION STEEL TECHNOLOGY PROGRAM. TECHNICAL REPORT NO. 10: FRACTURE TOUGHNESS CHARACTERIZATION STUDY OF A533, GRADE B, CLASS 1 STEEL
T. R. Mager Oct. 1970 39 p refs Prepared for ORNL
(Contract W-7405-eng-26)
(WCAP-7578) Avail: NTIS

The fracture toughness of various plates of material from the HSST program was characterized. The plate materials evaluated were HSST plates 01, 02, and 03. Fracture toughness (K sub Ic) properties were obtained at –150 F utilizing 1T compact tension specimens and at +10 F utilizing 4T compact tension specimens. Fracture mechanics was utilized to characterize the various HSST plate materials as a function of location throughout the thickness and throughout the length and breadth of the material. The effects of orientation of the specimen's notch with the primary working direction of the material on the fracture toughness were evaluated. The results indicate that the fracture toughness, K sub Ic, was essentially the same for HSST plates 01, 02, and 03. Specimen orientation did not have an effect on the measured K sub Ic values at –150 F. Author (NSA)

N71-21793# Mound Lab., Miamisburg, Ohio.
ELECTRON BEAM WELDING STUDY ON U Nb Zr ALLOY Final Report
J. R. McDougal and L. A. Greene 23 Dec. 1970 17 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1778) Avail: NTIS

An electron beam welding study was conducted on Mulberry alloy (U-7.5% Nb-2.5% Zr). The study was conducted on 0.080 and 0.250-in. thick sheet stock. The purpose of the study was to determine what effect the variation of welding parameters would have on weld characteristics in partial penetration welds. The use of a straight beam of electrons or ac deflection resulted in weld spiking and cold shut area in the 0.250-in. thick material. Circle generation drastically reduced the number of weld defects. The 0.080-in. thick Mulberry welded easily except when ac deflection was used where the amount of weld porosity in the fusion area was high. Author (NSA)

N71-21816 National Lending Library for Science and Technology, Boston Spa (England).

ELECTRODEPOSITION OF Ni-PHOSPHORUS ALLOYS AT VARIOUS CURRENT DENSITIES AND RATES OF ELECTROLYTE AGITATION

R. S. Vakhidov et al 21 Aug. 1970 6 p refs Transl. into ENGLISH from Izv. Akad. Nauk Kaz. SSR, Ser. Khim. (Kazakh SSR), v. 19, no. 3, p 36–41 In ENGLISH and RUSSIAN
(NLL-Trans-746-526-(9022.401); NLL-LTI-734-4637) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

During electrolysis of a solution, containing ions of nickel, sodium hypophosphite, boric and phosphoric acids, the concentration of phosphorus in a Ni-phosphorus alloy significantly decreases with an increase of the current density to 0.2 amp/sq cm. With further increase of the current density the composition of the cathodic alloy practically does not change. According to the increasing agitation of the electrolyte, the phosphorus content increases in the cathodic deposit, the deposition rate of the alloy decreases and the cathodic efficiency of the alloy decreases. From the solution investigated, a best Ni-phosphorus coating is obtained at 70 C in a current density range of 0.25–0.35 amp/sq cm without agitation.
Author

N71-21818 National Lending Library for Science and Technology, Boston Spa (England).

ELECTROPLATING WITH RHENIUM-NICKEL, RHENIUM-COBALT, RHENIUM-CHROMIUM AND RHENIUM-NICKEL-CHROMIUM ALLOYS

Z. M. Sominskaya et al 6 Jul. 1970 6 p refs Transl. into ENGLISH from Tr. Inst. Met. Akad. Nauk SSSR (Moscow), 1961 p 209–213 In ENGLISH and RUSSIAN
(NLL-Trans-746-501-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Dense electrodeposits of rhenium-nickel, rhenium-cobalt, and rhenium-chromium alloys were obtained on copper and chromium-nickel bases. Dense ternary alloy deposits of rhenium-nickel-chromium, containing 13.3% nickel and 5.4% chromium, were obtained on copper and chromium-nickel bases by electrodeposition according to the following system: KReO4 = 50 g/l, CrO3 = 20 g/l, NiSO4 = 100 g/l, H2SO4 = 75 g/l, (HH4)2SO4 = 40 g/l, cathodic current density 100 amp/d sq m, and temperature of electrolyte at 75 C.
Author

N71-21820 Ohio State Univ., Columbus.

REACTION-DIFFUSION IN A METAL-NONMETAL BINARY SYSTEM AND THE MULTICOMPONENT SYSTEMS Ti/SiC AND Ti-6Al-4V/SiC

John Leigh Ratliff (Ph.D. Thesis) 1969 145 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 70-6859

The results of X-ray analyses, metallography and electron microprobe analyses characterized the reaction zones of the various diffusion couples. In the Ti/SiC diffusion couples it was found that the nucleation and growth of a new phase within the reaction zone was associated with the transitions in the reaction kinetics of both the Ti/SiC and Ti-6Al-4V/SiC systems. In the Ti/SiC couples, the new phase was identified as the ternary phase; however, in the Ti-6Al-4V/SiC couples the new phase was not identified. Diffusion paths were constructed on a revised Ti-Si-C phase diagram for the various Ti/SiC diffusion reactions. Because of the inherent complexities in five component phase equilibria, no diffusion paths were proposed for the Ti-6Al-4V/SiC diffusion reactions. A mechanism was proposed for the Ti/SiC reactions whereby the relative mobilities of the diffusing species are primary factors which determine the sequence of phases within the reaction zones; thermodynamics provides a permissible framework for the reactions.
Dissert. Abstr.

N71-21823 National Lending Library for Science and Technology, Boston Spa (England).

VAPOUR PRESSURE STUDY OF THE IRON PENTACARBONYL-NICKEL CARBONYL SYSTEM

A. K. Baev May 1970 3 p Transl. into ENGLISH from Dokl. Akad. Nauk Belorussk. SSR (Minsk), v. 12, no. 10, 1968 p 918–922 In ENGLISH and RUSSIAN
(NLL-Trans-746-515-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Data on the vapor pressure for the Fe(CO)5-Ni(CO)4 system are set forth. The investigations were conducted by the vapor pressure method with a membrane null-manometer apparatus.
Author

N71-21833 National Lending Library for Science and Technology, Boston Spa (England).

INVESTIGATION OF THE DAMAGE IN CREEP SPECIMENS OF X8 Cr Ni Nb 16 13 (ATS) AND X 15 Cr Mo 13 (REMANIT 1515 Mo) IN THE TERTIARY CREEP RANGE

W. Schmidt 15 Jul. 1970 23 p refs Transl. into ENGLISH from Deut. Edelstahlwerke Tech. Ber. (Krefeld) v. 9, no. 2, 1969 p 264–272
(NLL-CE-Trans-5414-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Creep tests were performed on X 8 CrNiNb 16 13 and X 15 CrMo 13 specimens at 600 C and at various stresses. Emphases are placed on the third creep stage, recoverable structural changes, damage, and the effects of the reduction in cross sections.
Author

N71-21840 National Lending Library for Science and Technology, Boston Spa (England).

CONTRIBUTION TO STUDY OF MICRO-CRACKS IN MARTENSITE [PRISPEVEK KE STUDIU VZNIKU MIKROTHLIN V MARTENSITU]

J. Kucera et al 6 Jul. 1970 8 p refs Transl. into ENGLISH from Kovove Mater. (Czechoslovakia), v. 7, no. 6, 1969 p 497–509 In ENGLISH and CZECHOSLOVAKIAN
(NLL-Trans-746-537-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

A metallographic investigation of the microstructure of board-like martensite of the Fe-Ni-C system demonstrated the possibility of the emergence of micro-cracks in martensite with a relatively small tetragonality. A calculation of the stress, provoked on the boundary of the isolated martensite board placed in the austenite and its immediate surroundings, showed that the elastic stress in this situation would attain very high values; close to the theoretical values exceeding the usual stability of the Fe-Ni-C alloy. The values of strain gradient were found to be extremely high and indicate the possibility of the emergence of localized heterogeneous stress fields in the martensitic structure. Conditions of the emergence of microcracks, from the point of view of possible relaxation of induced stress after aging of the martensite, were determined.
D.L.G.

N71-21846 National Lending Library for Science and Technology, Boston Spa (England).

KINETICS OF ELECTROLESS NICKEL PLATING IN PRESENCE OF DIFFERENT ORGANIC ADDITIONS

T. N. Khopenya et al 26 Jul. 1970 3 p refs Transl. into ENGLISH from Zashchita Metal. (Moscow), v. 5, no. 6, 1969 p 689–691 In ENGLISH and RUSSIAN
(NLL-Trans-746-513-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

During nickel plating in a solution containing 20 g/l sodium acetate, the deposit increased linearly in the first 25 min. In this interval of 25-150 min the rate of reduction decreased approximately 2 times, although a considerable amount of the basic

components remained in the solution and the molar correlation NaH2PO2·H2O/NiCl2·6H2O decreased in the depleted solution by 12.5% - from 1.6 to 1.4. Curves characterizing the rate of nickel plating in the presence of 20 g/l malonic and 5 g/l gluteric acids correspondingly, also have an initial linear zone and a zone of retardation that indicates the slower decrease of the rate of reduction with time. With the approach of this retardation, considerable amounts of the basic components remain in these solutions. It is concluded that retardation of the process advances after precipitation from the solution of some amount of the Ni-P alloy. Author

N71-21847 National Lending Library for Science and Technology, Boston Spa (England).
STEEL FOR USE IN THE PRODUCTION OF PHOSPHORIC ACID
L. I. Posysaeva et al May 1970 3 p refs Transl. into ENGLISH from Zashchita Metal. (Moscow), v. 5, no. 6, 1969 p 623-626 In ENGLISH and RUSSIAN
(NLL-Trans-746-S14-(9022.401)) Avail: Natl. Lending Library, Boston Spa Engl.: 1 NLL photocopy coupon

Problems linked with the corrosion resistance of Fe-Cr-Ni steels with different Cr-Ni and Mo contents, were investigated in mixtures of industrial phosphoric acid fluorine compounds. It was shown that Mo and Cr are responsible for the corrosion resistance of the steel in these media. Author

N71-21848 National Lending Library for Science and Technology, Boston Spa (England).
OBTAINING A NICKEL-TIN-BORON ALLOY BY CHEMICAL REDUCTION
L. E. Tsupak et al 6 Jul. 1970 3 p refs Transl. into ENGLISH from Zashch. Metal. (USSR), v. 5, no. 6, 1969 p 688-689 In ENGLISH and RUSSIAN
(NLL-Trans-746-511-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Electrochemical reduction was used to obtain a ternary nickel-tin-boron alloy from solutions containing an ethylene-diamine nickel complex, sodium hydroxide, and sodium boron hydride. The reduced metal precipitated in the form of a suspension, leading to rapid decomposition of the solution. Addition of sodium stanate stabilized the solution and increased the alloy deposition rate as well as the tin content in the alloy. Nickel-tin-boron coatings can be deposited by this method on copper, nickel, platinum, and other metals. G.G.

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N71-20662# Army Materials and Mechanics Research Center, Watertown, Mass.
DYNAMIC RESPONSE OF A CONSTRAINED FIBROUS SYSTEM SUBJECTED TO TRANSVERSE IMPACT. PART 1: TRANSIENT RESPONSES AND BREAKING ENERGIES OF NYLON YARNS
Anthony F. Wilde, John J. Ricca, Lonnie M. Cole, and Joseph M. Rogers Nov. 1970 42 p refs
(AD-716983; AMMRC-TR-70-32-Pt-1) Avail: NTIS CSCL 11/5

The effects of high-speed transverse missile impact upon textile yarns were observed by high-speed photography in a study of the transient behavior of a series of nylon 6/6 yarns differing systematically in mechanical properties. The loss in missile kinetic energy was determined directly from the reduction in missile velocity. The shape of these energy loss curves was due to the partition of missile energy into yarn kinetic energy and yarn strain energy. Estimates were made of the yarn breaking strains for these impact tests. The effects of yarn tenacity and impact velocity (strain rate) upon the impact behavior of these yarns were discussed and compared to their static behavior. Comparisons were also made with the effect of strain rate upon the breaking energies of nylon yarns reported in the literature. Author (GRA)

N71-20742* State Univ. of Iowa, Iowa City.
MIXTURE SEPARATION CELL Patent
Coleman J. Major, Karl Kammermeyer, and Richard W. Tock, inventors (to NASA) Issued 5 Dec. 1967 (Filed 6 Jan. 1966) 7 p Cl. 55-158 Sponsored by NASA
(NASA-Case-XMS-02952; US-Patent-3,355,861; US-Patent-Appl-SN-519160) Avail: US Patent Office CSCL 11D

A separation cell is described for separating fluid mixture components by permeation through stacked permeation units, each of which is connected to a supply conduit for receiving the mixture and to removal conduits for withdrawing mixture components. Each permeation unit is comprised of a permeable selective membrane and a porous conduit sheet in fluid communication with the supply conduit and in an abutting laminar relationship with the membrane. The stacked permeation units are arranged with the perm-selective membranes disposed in alternating transverse relationships with the porous conduit sheets so that only a portion of the surface areas of the abutting membranes and porous conduit sheets provides the permeation surface. Each perm-selective membrane sealingly encloses a porous paper substrate which transmits the mixture components which have permeated the membrane. Official Gazette of the U.S. Patent Office

N71-20807# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF PRELIMINARY LOADING ON THE MECHANICAL CHARACTERISTICS OF UNIDIRECTIONAL FIBERGLASS REINFORCED PLASTICS
V. P. Yatsenko et al 26 Oct. 1970 8 p refs Transl. into ENGLISH from Dopov. Akad. Nauk Ukr. RSR, Ser. A, F.-T. M. N. (Kiev), v. 29, no. 7, 1967 p 646-648
(AD-717019; FTD-HC-23-1323-68) Avail: NTIS CSCL 11/9

The existence of the Bauschinger effect was examined for unidirectional glass reinforced plastic EFB-3S in the form of ring specimens. The material was loaded repeatedly up to 80 percent of ultimate tensile strength with the rate 8,000 kg/min., the value of ultimate tensile strength after preliminary loading was detd. in the 5th or in the 10th cycle resp. The starting value of ultimate tensile strength decreases 10,100 to 9,600 sq kg/cm and the value of elastic modulus increases from 465,000 to 490,000 sq kg/cm after preliminary loading. The observed changes do not exceed the interval of scattering of expti values. Author (GRA)

N71-20808# Chemical Systems, Inc., Santa Ana, Calif.
HEAT RESISTANT POLYMERS CONTAINING THE LOW MOLECULAR WEIGHT CLOSO-CARBORANES. 2: THERMAL BEHAVIOR OF POLYCARBORANESILOXANE SiB-1 ELASTOMERS FROM C2B5H7
Robert E. Kesting, Kenneth F. Jackson, and J. M. Newman 1 Jan. 1971 15 p refs Submitted for publication
(Contract N00014-70-C-0109)
(AD-716802; TR-3) Avail: NTIS CSCL 7/2

Unmodified 5-SiB-1 polymers have been found to be at least equivalent to their 10-SiB-1 counter-parts with respect to thermal stability. The 5-SiB-1 polymers, moreover, are substantially more amenable to conversion into elastomers. The introduction of

15 to 20 mole per cent of m-C2B10 into the 5-SiB-1 backbone results in elastomers whose thermal stability, although less than that of the parent homopolymer is, nevertheless, substantially in excess of the published values for other carboranesiloxane polymers. The crystallization of the 5-SiB-1 copolymer containing 15 mole per cent C2B10 was inhibited by irradiation with 50 megarads of 3 mev betas. The 5-SiB-1 copolymer containing 20 mole per cent C2B10 on the other hand, remained a rubber at room temperature.
Author (GRA)

N71-20915# Royal Netherlands Aircraft Factories Fokker, Amsterdam.
MEASUREMENT ON THE EFFECTS OF VACUUM OR RADIATION ON POLYMERS Technical Report No. 1
A. Kersting 15 Oct. 1969 28 p refs
(Contract ESTEC-647-69-AA)
(R-1107; TR-1) Avail: NTIS

In order to measure the effect of space environmental conditions on polymers, six commercial adhesives were investigated. A series of specimens were exposed in a vacuum chamber at two different temperatures and during three different periods. After the tests the mechanical properties (shear and peel) were measured. It is concluded that vacuum exposure did not show any deterioration.
ESRO

N71-20916# Northwestern Univ., Evanston, Ill. Materials Research Center.
ADVANCED MATERIALS RESEARCH Annual Report, 1 Oct. 1969 - 30 Sep. 1970
30 Sep. 1970 226 p refs
(Contract ARPA SD-67-DAHC15-67-C-0213)
(AD-717094; AR-11) Avail: NTIS CSCL 11/7

The Annual Report is a condensed account of the total materials research activities of all members of the Materials Research Center at Northwestern. Presented herein are brief descriptions of the various individual research programs active during the 1969/70 year, arranged alphabetically by the name of the principal investigator. Also included are lists of publications and invited talks stemming from the research and the names of research associates and graduate students affiliated with each project. Author (GRA)

N71-20926# Royal Aircraft Establishment, Farnborough (England).
THERMOSTABLE POLYMERS AND FIBRES BASED ON THEM [TERMOSTOIKIE POLIMERY I VOLOKNA NA IKH SNOVE]
G. I. Kudryavtsev Aug. 1970 26 p refs Transl. into ENGLISH from Khim. Volokna (Moscow), v. 4, 1969 p 23 - 32
(RAE-LIB-TRANS-1500) Avail: NTIS

Thermally stable fiber technology is reviewed and a comparison is made of the thermal stability of fibers based on the temperature for 50% retention of mechanical properties with the thermal stability of the base polymer based on weight loss measurements.
Author

N71-21000# Scientific Research Atomic Reactor Inst., Melekess (USSR).
AN ANALYSIS OF THE VARIATION OF THE DEFORMATION PROCESSES OF CONSTRUCTION MATERIALS AFTER REACTOR IRRADIATION, PART 1
V. D. Balashov and S. N. Votinov 1970 30 p refs In RUSSIAN
(SRARI-P-85) Avail: NTIS

The comparison of strain mechanisms of unirradiated and neutron irradiated fcc and bcc construction materials has been carried out. Serrated strain, rate dependence, and high temperature annealing effects were investigated. The role of radiation defects in low- and high-temperature radiation embrittlement phenomena is explained.
Author (NSA)

N71-21001# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF ADDITIVES OF RARE EARTH OXIDES ON THE POLYMORPHISM OF ZIRCONIUM DIOXIDE
V. B. Glushkova et al 28 Oct. 1970 15 p refs Transl. into ENGLISH from Proc. of 2d Vsesoyuznoe Soveshch. Po Khim. Okislov Pri Vysokikh Temperaturakh, Khim. Vysokotemperaturnykh Materialov, Tr. (Leningrad), 1967 p 83 - 90
(AD-717059; FTD-HC-23-1446-68) CSCL 7/4

Zirconium oxide, which melts at 2700 C, is a promising material for high temperature technology. The sharp volume changes which occur during phase transformations lead to cracking of objects made of zirconia. Consequently, stabilization of zirconium oxide in cubic or tetragonal modifications has been treated in a large number of investigations, but the solution of this problem has not been obtained up to the present time. The article presents data on changes of free energy of zirconium dioxide and its solid solutions as a function of temperature, changes of linear dimensions of specimens as a function of temperature and composition of solid solutions. In addition, the article gives phase diagrams for given zirconium oxide systems. It is concluded that the best stabilizers of zirconium oxide in cubic form are oxides of heavy rare earth elements and yttrium oxide. With the use of these compounds a minimum amount of additives are necessary (3-7 mole percent), and the solid solutions which are formed are stable in a variety of gaseous media and do not suffer phase changes up to 2000C.
Author (GRA)

N71-21025*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
DEVELOPMENT OF TECHNIQUES AND ASSOCIATED INSTRUMENTATION FOR HIGH TEMPERATURE EMISSIVITY MEASUREMENTS Quarterly Progress Report, 30 Sep. - 31 Dec. 1970
G. R. Cunnington and A. I. Funai 31 Dec. 1970 77 p refs
(Contract NAS8-26304)
(NASA-CR-103071; N-JF-71-1; QPR-2) Avail: NTIS CSCL 11C

The environmental stimulation requirements on measurement problems for emittance testing of space shuttle vehicle external surface materials are presented with recommendations for test conditions. Emittance data for a ceramic coating and an oxidized superalloy (6605) are discussed. Recommendations for the experimental method and apparatus configuration are summarized.
Author

N71-21029# Naval Ordnance Lab., White Oak, Md.
SYNTHESIS OF POLYQUINOXALINES CONTAINING CARBONYL GROUPS IN THE POLYMER CHAIN
J. M. Augl and W. J. Wrasidlo Nov. 1970 12 p ref
(AD-716742; NOLTR-70-200) Avail: NTIS CSCL 7/3

The synthesis of five new polyquinoxalines from 3,3,4,4-tetraaminobenzophenone and aromatic bisglyoxals is described. The polymers were thoroughly characterized. The inherent viscosities range from 0.55 to 2.05 dl/g, and their polymer decomposition temperatures range from 440 - 520C. Unlike the unsubstituted polyquinoxalines, the phenyl substituted polyquinoxalines have good solubility in phenolic and certain chlorinated solvents. They also show considerably better thermal-oxidative stability.
Author (GRA)

N71-21036# Royal Netherlands Aircraft Factories Fokker, Amsterdam.
MEASUREMENT ON THE EFFECTS OF VACUUM OR RADIATION ON POLYMERS Technical Report No. 4
A. Kersting 6 Apr. 1970 26 p
(Contract ESTEC-647-69-AA)
(R-1173; TR-4) Avail: NTIS

In order to measure the effect of space environmental conditions on polymers, five commercial adhesives were investigated. A series of specimens were exposed in a vacuum chamber at two

different temperatures and during three different periods. After the tests the mechanical properties (shear and peel) were measured. It is concluded that vacuum exposure did not show any deterioration.
ESRO

N71-21068* Space Technology Labs., Inc., Redondo Beach, Calif.
PRESTRESSED REFRACTORY STRUCTURE Patent
Herbert Shieber, inventor (to NASA) Issued 17 Oct. 1967 (Filed 5 Nov. 1964) 5 p Cl. 239-265.11 Sponsored by NASA
(NASA-Case-XNP-02888; US-Patent-3,347,465; US-Patent-Appl-SN-409126) Avail: US Patent Office CSCL 11D

A prestressed rocket nozzle consisting of ceramic inner rings and refractory metal outer rings is described. The outer rings are stressed in tension, and do not come in contact with the hot gases.
F.O.S.

N71-21228*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A STUDY OF THE REQUIRED CRITICAL ASPECT RATIO OF FIBERS IN COMPOSITES INTENDED FOR STRESS RUPTURE APPLICATIONS
R. W. Jech 1971 12 p refs Presented at 2d Ann. Conf. on Composite Materials, Anaheim, Calif., 20–22 Apr. 1971; sponsored by Am. Soc. for Testing and Materials.
(NASA-TM-X-52993; E-5407) Avail: NTIS CSCL 11D

The observed critical aspect ratio for pull-out specimens of tungsten wire and a copper matrix tested in stress-rupture at 649 and 816 C was slightly greater than for tension tests at the same temperature. Time for failure of the stress-rupture specimens was controlled by the properties of the fiber (tungsten) at aspect ratios greater than the critical aspect ratio and by the properties of the matrix (copper) at aspect ratios less than the critical ratio.
Author

N71-21288# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DEPOSITION OF A PROTECTIVE COATING FROM THE GAS PHASE ON THE SURFACE OF SOLID BODIES
S. A. Klevtsur et al 4 Sep. 1970 8 p Transl. into ENGLISH from Zashchitn. Pokrytiya Na Metallakh (USSR), no. 2, 1968 p 46–49
(AD-717031; FTD-HT-23-582-70) Avail: NTIS CSCL 7/4

The process of depositing protective carbide, nitride, boride, and pyrocarbon coatings from the gas phase, represents a case of a complex, gaseous heterogeneous-catalytic reaction. To understand the mechanism of the reaction, the speed of the surface deposition process, depending on the temperature and concentration of the chemical element forming a protective coating, must be determined. The authors derive equations for determining the speed of deposition of a protective coating from a jet of the reactive gas mixture on the walls of channels in an arbitrary body. It is assumed that the reaction proceeds on the wall surface and that the gas phase is the reservoir controlling the concentration of components on the surface. The speed of deposition of the protective coating relative to the change in concentration and temperature is considered per unit of length.
Author (GRA)

N71-21310# Dayton Univ. Research Inst., Ohio.
A COMPUTER METHOD FOR THE THERMOGRAVIMETRY OF ABLATIVE PLASTIC MATERIALS. EMPIRICAL KINETICS AND THERMOGRAM CONSTRUCTION Technical Report, Mar. 1969–Mar. 1970
N. J. Olson Oct. 1970 49 p refs
(Contract F33615-69-C-1385)
(AD-716825; AFML-TR-70-262) Avail: NTIS CSCL 7/4

In constant heating rate thermogravimetry experiments, a material is heated at a constant rate of temperature change. A thermogram of weight versus temperature is simultaneously recorded. The weight of a polymer during pyrolysis was represented by a kinetic equation of the Arrhenius form. The three empirical kinetic parameters for this equation were derived from a novel computer program using the experimental thermogram. A magnetic tape was also produced in a separate operation for a CalComp plotter. The plotter reconstructs the thermogram for the evaluation of any calculational error and comparison with previous results or theory. The report reviews the primary computer code (TRIM) which is used to calculate the empirical kinetic parameters from the integral weight and temperature values derived from the experimental thermogram. The magnetic tape/plotter subroutine (PAR-3) is then discussed in detail. This subroutine constructs a thermogram from parameters generated by the code (TRIM). An analysis was made for a polyimide resin run at four rates of heating for purposes of illustration. Calculated and experimental residual weights were compared at selected temperatures.
Author (GRA)

N71-21319 Northwestern Univ., Evanston, Ill.
DISPERSION RELATIONS FOR FIBER REINFORCED MEDIA
Robert Thomas Lentz (Ph.D. Thesis) 1969 82 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 70-6491

A method is advanced for the purpose of determining dispersion relations for a fiber-reinforced material. Because of the periodicity of the fibers, the composite material is approximated by representing the material properties in a Fourier series. The composite, made up of two distinct materials, becomes a continuum with variable material properties. The equations of motion, when formulated, are found to be coupled. However, the coupling terms are ignored in the method, and the solution is assumed to be of the same form as that used to solve Mathieu's equation. It is shown that the approach is justified by solving for the dispersion relations of a laminated media with the approximate theory and comparing the results with results obtained with a known exact solution. Dispersion relations are given for a laminated media and a fiber-reinforced media.
Dissert. Abstr.

N71-21349*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MATERIALS
In its Space Programs Sum. No. 37-66, Vol. 3, Oct. – Nov. 1970 31 Dec. 1970 p 111–199 refs (See N71-21338 10-30)
Copyright. Avail: NTIS CSCL 11A

Polyimide, polybenzimidazole, and polyquinoxaline polymers were evaluated for their use as spacecraft adhesives by their thermal shock resistance properties at both elevated and cryogenic temperatures. Polyimide evolved as best suited for structural bonding applications in future spacecraft where high thermal shock is encountered. Cracking analyses on modified optical layers of a solar cell filter attributed damage to initial stresses set in during manufacturing of the complex filter; exposure to substantial temperature changes aggravated the dormant problem. The construction of a furlable conical-Gregorian high gain antenna is described that uses a thick, self-supporting membrane with a furlable outer ring supported from the center hub by a medium of radial ribs.
G.G.

N71-21378 National Lending Library for Science and Technology, Boston Spa (England).
MECHANISM OF ADHERENCE OF PLASMA-SPRAYED COATINGS TO THE SUBSTRATE
V. P. Eluytin et al 21 Aug. 1970 4 p refs Transl. into ENGLISH from Fiz. Khim. Obrab. Mater. (USSR), no. 3, 1969 p 46–49 In ENGLISH and RUSSIAN
(NLL-Trans-734-4553-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

To obtain qualitative adherence of plasma sprayed coatings to the substrate, it is necessary to explain the contribution of the interatomic interaction to the general connection between the metals of the coating and the substrate. The mechanism of adherence of

plasma sprayed coatings to the base material, depending on the nature of the coating-substrate pair, was investigated. A formula for the calculation of the temperature in the contact liquid drop-substrate at the moment of contact is proposed. It is shown that the temperature at the contact is a qualitative criterion for an evaluation of the adhesion. Author

N71-21392# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MOLYBDENUM DISULFIDE: ITS PROPERTIES AND APPLICATIONS [DISULFIED MOLIBDENA, EGO SVOISTVA I PRIMENENIE]

L. I. Pugina et al 27 Oct. 1970 53 p refs Transl. into ENGLISH from the Russian

(AD-716940; FTD-HC-23-463-70) Avail: NTIS CSCL 11/8

Information is given on the effect of the purity and size of powder particles, of the material and quality of machining of a friction pair, and operating conditions for a friction part (temperature and composition of the surrounding medium, sliding speed, pressure, etc.) on the properties of molybdenum disulfide as a lubricant. The means of introducing the lubricant into the friction zone are described and the regions where it is applied are indicated. Author (GRA)

N71-21501# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d-Etudes Nucleaires.

MECHANICAL PROPERTIES OF CERAMICS CONTAINING URANIUM AND PLUTONIUM [PROPRIETES MECANIQUES DE CERAMIQUES A BASE D'URANIUM ET DE PLUTONIUM]

Charles-Henri de Novion, Bernard Amice, Alain Groff, Yannick Guerin, and Andre Padel 1970 15 p refs In FRENCH Presented at 4th Intern. Conf. on Plutonium and other Actinides, Santa Fe, N.Mex., 5 – 9 Oct. 1970

(CEA-CONF-1620; CONF-701001-9) Avail: AEC Depository Libraries

Young modulus E of mixed uranium plutonium carbides and nitrides was measured as a function of the porosity P(Pu/U + Pu = 0.15 or 0.20) at room temperature. Young modulus of carbonitrides is maximum for x approximates 0.80. Young modulus of mixed oxides is maximum for the stoichiometry y = 0. Young modulus of mixed stoichiometric oxides increases with the plutonium concentration. Author (NSA)

N71-21523# Naval Civil Engineering Lab., Port Hueneme, Calif.

AIRFIELD MARKING PAINTS FOR ASPHALTIC PAVEMENTS

Richard W. Drisko Dec. 1970 71 p refs

(AD-716755; NCEL-TR-705) Avail: NTIS CSCL 11/3

Specially formulated marking paints for striping airfields were field tested. The polyvinyl acetate paint at CBC, Port Hueneme was still in excellent condition 4 years after application. In all cases single-thickness ratings were as good as or better than corresponding double-thickness ratings, especially for the double-thickness alkyd ratings. The polyvinyl acetate paint performed best on the runway at Guam, but the three oleoresinous phenolic varnish paints and one of the two alkyd paints performed slightly better on the roadway. On a runway at NAS, Point Mugu the polyvinyl acetate paint performed the best of the six paints tested. Miscellaneous problems with airfield marking paints at other activities are discussed and solutions presented. Laboratory tested included analyzing water-emulsion paints for possible use as marking paints and developing simple test procedures for identifying alkyd and chlorinated resins in fresh and weathered marking paints. Author (GRA)

N71-21524# Florida State Univ., Tallahassee.

THE EFFECTS OF THE QUANTITY AND PLACEMENT OF COPOLYMER UNITS WITHIN THE POLYMERIC CHAIN ON THE CRYSTALLIZATION PHENOMENA IN POLYMERS

Technical Report, Dec. 1968 – Apr. 1970

L. Mandelkern Wright-Patterson AFB, Ohio AFML Oct. 1970 28 p refs

(Contract F33615-69-C-1249)

(AD-716824; AFML-TR-70-196) Avail: NTIS CSCL 7/4

The crystallization kinetics of random copolymers containing linear polyethylene as the major constituent and methyl and m-propyl side groups as counits have been studied by dilatometric techniques. Major attention has been given to the analysis of the temperature coefficient of the process which is demonstrated to be nucleation controlled. It is found that, irrespective of the mode of nucleation selected, there is a systematic increase in the crystallite interfacial free energy with increasing copolymeric content. The major increase occurs at copolymer compositions where spherulitic structures are no longer resolved. The values deduced for the interfacial free energy strongly favor the three-dimensional mode of nucleation. Author (GRA)

N71-21525# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

METHOD FOR TESTING THE WEAR OF POLYMERIC COATINGS

P. I. Zubov et al 22 Oct. 1970 11 p refs Transl. into ENGLISH from Lakokrasochnye Materialy i Ikh Primenenie (Moscow), no. 4, 1969 p 53 – 55

(AD-717039; FTD-HC-23-462-70) Avail: NTIS CSCL 11/3

The wear resistance of thin polymer coatings, e.g., pentaphthalic coatings PF-053 and PF-060, a Glyptal-resin export coating and cold and hot-hardening enamels PF-133, PF-115, and KF-243, were tested on an app. having a vibrating indenter. The shape (conical or cylindrical) and the area of the indenter affected the wear of the coating. The latter was proportional to the amplitude of the vibrations of the indenter. The experiments were best conducted at 200-800 Hz, since intensive wear showed reliable results in that frequency range. Hot-hardening alkyd resins (varnishes and enamels) showed superior wear resistance. Author (GRA)

N71-21532# Sandia Corp., Albuquerque, N.Mex.

ELECTROOPTIC PROPERTIES OF Ba, Sn, AND La MODIFIED LEAD ZIRCONATE TITANATE CERAMICS

C. E. Land and P. D. Thacher Oct. 1970 50 p refs Reprinted Supported by AEC

(SC-R-70-4353) Avail: NTIS

Electrooptic effects are discussed in ferroelectric lead zirconate titanate ceramic materials and include the transverse electrooptic effects (linear, quadratic, and memory), strain-biased longitudinal electrooptic memory effect, and electrically controlled scattering. The electrooptic memory effects are related to variations of ceramic birefringence with remanent polarization. All the above electrooptic effects are found in Ba, Sn, and La modified lead zirconate titanate ceramics except electrically controlled scattering. Both the character and magnitude of these effects are strongly dependent on the composition and grain size of the ceramic material as well as on the temperature and light wavelength of observation. The results for the La modified ceramics, which can be made highly transparent, are discussed in the greatest detail. The various electrooptic effects are shown to arise either from orientation of ferroelectric domains or from field-enforced ferroelectric distortion of certain paraelectric materials. Author

N71-21585 National Lending Library for Science and Technology, Boston Spa (England).

THE REACTIVITY OF ARTIFICIAL GRAPHITES FOR CONSTRUCTIONAL PURPOSES [REAKTSIONNAYA SPOSOBNOST ISKUSSTVENNYKH GRAFITOV KONSTRUKTSIONNOGO NAZNACHENIYA]

G. M. Volkov Sep. 1970 30 p refs Transl. into ENGLISH from Khim. Tverd. Topl. (Moscow), no. 2, 1969 p 91 104
(NLL-RTS-5841) Avail: Natl. Lending Library, Boston Spa, Engl.: 60s; 10 NLL photocopy coupons

The reactivity of artificial graphites, taking into account the heterogeneity of the structure, predetermined by their production technology, is presented. Three manufactured types of artificial graphite, differing from one another in the granulometric composition of the filler (at equal density), and in density (with equal coarseness of the filler) were used. Author

N71-21637# Oak Ridge National Lab., Tenn.
URANIUM AND THORIUM DIFFUSION IN COLUMNAR PYROCARBONS AS INFLUENCED BY ACTINIDE
R. B. Evans, III J. O. Stiegler, comps. Jan. 1971 45 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2989) Avail: NTIS

Thin layer depletion experiments were conducted that yield coefficients at low actinide concentrations applicable in the stabilized regime, where the coefficients are true constants, and also at intermediate concentrations (or regions), where coefficients are concentration dependent. Constant potential experiments were also conducted that yield diffusion coefficients applicable at very high concentrations and also an apparent solubility C sub 0. The C sub 0 corresponds to the maximum uranium concentration the pyrocarbon can attain without undergoing detectable structural changes. The densities of the pyrocarbons were greater than 2.0 g/cu cm. Author (NSA)

N71-21651* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HONEYCOMB PANEL AND METHOD OF MAKING SAME Patent
Robert J. Carmody, inventor (to NASA) Issued 10 Oct. 1967 (Filed 4 Dec. 1963) 8 p Cl. 161-68
(NASA-Case-XMF-01402; US-Patent-3,346,442; US-Patent-Appl-SN-328140) Avail: US Patent Office CSCL 11D

A method is described for honeycomb panel bonding by a thermosetting film adhesive which has incorporated an electrical heat producing mess. This is accomplished by imbedding heating wires in the film through which an electric current is passed. F.O.S.

N71-21841*# Los Alamos Scientific Lab., N.Mex.
CMF-13 RESEARCH ON CARBON AND GRAPHITE Summary Progress Report, 1 May–31 Jul. 1970
Morton C. Smith Oct. 1970 26 p Sponsored in part by NASA
(Contract W-7405-eng-36)
(NASA-CR-117494; LA-4526-MS; Rept-14) Avail: NTIS CSCL 11D

Research and development on carbon and graphite were undertaken primarily to increase understanding of their properties and behavior as engineering materials, to improve the raw materials and processes used in their manufacture, and to learn how to produce them with consistent, predictable, useful combinations of properties. The approach taken is microstructural, based on study and characterization of natural, commercial, and experimental carbons and graphites by such techniques as X-ray diffraction, electron and optical microscopy, and porosimetry. Physical and mechanical properties are measured as functions of formulation, treatment, and environmental variables, and correlations are sought among properties and structures. Results of research are included on Santa Maria coke, particle packing, binder chemistry, extruded graphite, graphite-carbide composites, effects of porosity on graphite properties, skin effects in graphite, and graphitization processes. NSA

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N71-20653*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ACCEPTANCE SAMPLING FOR THE NORMAL DISTRIBUTION: STANDARD DEVIATION UNKNOWN BUT ASSUMED CONSTANT
Steven M. Sidik Washington Mar. 1971 21 p refs
(NASA-TN-D-6288; E-6034) Avail: NTIS CSCL 12A

Often an estimate of the standard deviation based on existing data is used as a fixed value in a series of standard deviation known sampling plans. It is shown that this causes the operating characteristic curve of the standard deviation known plan to become a random variable. Its distribution depends upon the distribution of the estimate of the standard deviation. A method is then presented for computing confidence limits on the attained curve. It is also shown how to solve the converse problem of attaining specified limits on the curve for any given true proportion defective. Author

N71-20668# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
ON THE EXACT DISTRIBUTIONS OF THE EXTREME ROOTS OF THE WISHART AND MANOVA MATRICES Final Report
P. R. Krishnaiah and T. C. Chang Sep. 1970 22 p refs
(AD-716815; ARL-70-0171) Avail: NTIS CSCL 12/1

The authors give exact expressions for the probability distribution functions of the extreme roots of the Wishart and Manova matrices by making use of an elegant method of Mehta for the evaluation of certain integral. Some remarks are also made as to how to evaluate the cumulative distribution functions of these distributions. The expressions obtained are in terms of pfaffian (square roots of the determinants of skew symmetric matrices of even order); here the authors note that a pfaffian can be expressed as a polynomial and so the expressions obtained here are useful for computational purposes. Author (GRA)

N71-20785 National Physical Lab., Teddington (England). Div. of Numerical and Applied Mathematics.
AN ALGORITHM FOR THE INTEGRATION OF UNEQUALLY SPACED DATA
P. E. Gill and G. F. Miller Dec. 1970 18 p ref
(NPL-Ma-93) Copyright. Avail: Issuing Activity

A method is described for the numerical integration of unequally spaced data using cubic interpolation. The classical integration formulas employing divided differences have been adapted to permit easy and systematic computation, and the method embodied in an ALGOL procedure allowing integration between any pair of the ordered data points. The error assessment is made by comparing a result with the corresponding result obtained by a process of piecewise quartic interpolation. Author (ESRO)

N71-20784# Joint Publications Research Service, Washington, D.C.
ALGEBRA OF CONFLICT
V. A. Lefevr et al 23 Mar. 1971 61 p refs Transl. into ENGLISH of the book 'Algebra Konflikta' Moscow, 1968 p 1–64
(JPRS-52700) Avail: NTIS

The intellectual interactions of conflicting sides are discussed as a reflexive game in which the opponents guess at the reasonings of each other. Chess is considered a game suited for viewing a

reflexive game with conflict situations. It is concluded that incompatibility, contradiction of plans, manifested through incompatibility of goals is the key to the nature of any conflict.
F.O.S.

N71-20820# Norges Tekniske Hoegskole, Trondheim. Inst. for Kjemiteknikk.
A MATHEMATICAL MODEL OF A CRYSTALLIZER BASED ON PHYSICO-CHEMICAL VELOCITY RATES FOR THE SUBPROCESSES INVOLVED [OPPSTILLING AV MATEMATISK MODELL FOR EN KRYSTALLISATOR, BASERT PA FYSIKALSK-KJEMISKE HASTIGHETSRELASJONER FOR DE DELPROSESSER SOM INNGAR]
Karl J. Holst Aug. 1969 150 p refs In NORWEGIAN; ENGLISH summary Sponsored by Roy. Norweg. Council for Sci. and Ind. Res.
Avail: NTIS

A future aim is the control of the dynamic interaction between supersaturation, the formation of cells, and the growth of crystals. An attempt has been made to arrive at mathematical correlations giving a satisfactory description of the working conditions of a test crystallizer.
Author (ESRO)

N71-20821# Norwegian Computing Center, Oslo (Norway).
PSEUDO-BOOLEAN ALGEBRA [PSEUDO-BOOLSK ALGEBRA]
Per Fersnes May 1969 20 p In NORWEGIAN; ENGLISH summary
Avail: NTIS

Pseudo-Boolean equations and inequalities with solution methods are discussed.
Author (ESRO)

N71-21002# Rome Univ. (Italy). Inst. of Physics.
POSSIBLE TESTS OF THE VALIDITY OF CURRENT ALGEBRA OR FIELD ALGEBRA COMMUTATORS
A. Bietti 29 Jul. 1970 12 p refs *Its* Nota Interna No. 280
Avail: NTIS

Sum rules derived from equal time commutators, such as the magnetic moment sum rule using quark models and the electric dipole sum rule, are examined to see whether or not a reasonable saturation of them could give some indication in order to choose between current or field algebra. It is concluded that although no choice could be made, the quark model method was favored.
ESRO

N71-21020# Los Alamos Scientific Lab., N.Mex.
TRANSPORT THEORY: DISCRETE ORDINATES QUADRATURE OVER THE UNIT SPHERE
Bengt G. Carlson Sep. 1970 16 p refs
(LA-4554) Avail: NTIS

Symmetric quadrature sets, defined over the surface of the unit sphere, are developed for use with the discrete ordinates method in transport theory to improve the quality of numerical solutions, especially in the case of geometries with two or more dimensions. The sets are constructed so that the quadrature points are invariant with respect to certain reflections and rotations of the unit sphere.
Author (NSA)

N71-21287# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Mechanical Engineering.
NONLINEAR ON LINE RAPID ESTIMATION SCHEME WITH APPLICATION TO TRAJECTORY MANEUVERING VEHICLE
K. Yong and C. N. Shen 1970 33 p refs
(Contract DAAB07-69-C-0365)
(AD-717104) Avail: NTIS CSCL 12/1

The problem of the on-line state estimation for a nonlinear process subjected to some unknown inputs is studied for both standard extended filtering and the rapid estimation scheme. The rapid estimation is derived from a specific cost functional and is used for estimating the initial values of the states and the states immediately following the application of the unknown input. The digital computer evaluation of the rapid estimation scheme for tracking a thrust maneuvering space vehicle shows that the estimates of the states by the rapid estimation scheme is superior to the results obtained from the standard extended filtering technique.
Author (GRA)

N71-21341*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPUTATION AND ANALYSIS
In its Space Programs Sum. No. 37-66, Vol. 3, Oct. – Nov. 1970 31 Dec. 1970 p 10 – 12 refs (See N71-21338 10-30)
Copyright. Avail: NTIS CSCL 12A

The QR algorithm for symmetric diagonal matrices is used to construct an orthonormal or unitary transformation of a Hermitian matrix to a symmetric tridiagonal matrix. The matrix product Y = Q sub 1 ... Q sub n-2 is used to overwrite the entirety of the working array which holds A in storage without additional computer storage requirements. A diagonal unitary transformation is constructed so that B = ZTZ super H is real, tridiagonal and symmetric. The eigenvalues and eigenvectors of B are found by the QR algorithm. The entire computation is arranged so that: (1) only the upper triangular part of A is used for computing; (2) the eigenvectors for A overwrite the entirety of the working array which holds A in storage; and (3) only n additional complex entries are required in the computer.
G.G.

N71-21393 University of Southern Calif., Los Angeles.
FINITE DIMENSIONAL SENSOR ORBITS AND OPTIMAL NONLINEAR FILTERING
James Ting-ho Lo (Ph.D. Thesis) 1969 62 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 70-5220

The filtering problem of a system with linear dynamics and non-Gaussian a priori distribution is thoroughly investigated. The conditional probability density, conditional mean and conditional error covariance for this class of nonlinear problem are obtained in terms of an ordinary integral which is analogous to the solution of a heat flow problem of an infinitely long, homogeneous rod with a certain initial heat distribution. An approximation made in the construction of a mathematical model is introduced. It renders the optimal estimation to a combination of linear estimations and thus gives satisfactory filtering in practice. The asymptotic behavior of the filter is examined. The limiting distributions of the conditional mean and the conditional error covariance exist as the time interval of observation becomes infinite. In the autonomous case, the estimate for the Wiener problem satisfies a linear stochastic differential equation.
Dissert. Abstr.

N71-21470*# Oklahoma State Univ., Stillwater. Dept. of Mathematics.
MULTIPLE ZEROS OF POLYNOMIALS
Craig A. Wood [1970] 329 p refs
(Grant NGR-37-002-084)
(NASA-CR-114931) Avail: NTIS HC $6.00/MF $0.95 CSCL 12A

Various classical methods exist for extracting the zeros of a polynomial p(x) equals a sub 1 X to the Nth power - a sub 2 X to the (N-1) power - a sub (N – 1) where a sub 1 does not equal 0 and a sub 1, a sub 2,...,a sub (N - 1) are complex numbers, when N = 1,2,3,4. For polynomials of higher degree, iterative numerical methods must be used. Four iterative methods are presented for approximating the zeros of a polynomial using a digital computer. Newton's method and Muller's method are two well known iterative methods which are presented. They extract the zeros of a polynomial by generating a sequence of approximations converging to each zero. However, both of these methods are very

unstable when used on a polynomial which has multiple zeros. That is, either they fail to converge to some or all of the zeros, or they converge to very bad approximations of the polynomial's zeros. Two new methods, the greatest common divisor (G.C.D.) method and the repeated greatest common divisor (repeated G.C.D.) method, which are superior methods for numerically approximating the zeros of a polynomial having multiple zeros are discussed. The above methods were all programmed in FORTRAN 4 and comparisons in time and accuracy are given. Author

N71-21477# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
BOUNDS FOR APPROXIMATE SOLUTIONS TO THE OPERATOR DIFFERENTIAL EQUATION Y PRIME (t) = M(t) Y(t); APPLICATIONS TO MAGNUS EXPANSION AND TO SECOND DERIVATIVE OF u + [1 + f(t)]u = 0
Ralph Wilcox Mar. 1970 32 p refs
(Contract AT(11-1)-113; Grant NSF GP-8960)
(TID-25627; TR-70-15) Avail: NTIS

A precise criterion of closeness for the approximate solution to the operator differential equation Y prime(t) = M(t)Y(t) is given. Theorems concerning error bounds are then proved, and applied to the first Magnus approximation and to the differential equation u double prime + (1 + f(t))u = 0. This differential equation is solved exactly for a rectangular shaped f(t) in order to compare with the first Magnus approximation. An exact solution to this equation is given for the case where f(t) varies infinitely slowly. Author

N71-21502# California Univ., Los Angeles. School of Engineering and Applied Science.
ON DYNAMIC SYSTEMS WITH DECENTRALIZED CONTROL Interim Report
Masanao Aoki 14 Dec. 1970 7 p refs
(Grants AF-AFOSR-1328-67B; NSF GK-2032)
(AD-716922; AFOSR-70-2892TR) Avail: NTIS CSCL 12/1

The paper discusses stabilizability of decentralized linear dynamical systems with proportional feedback or dynamic controllers. Decentralized control systems are defined to be dynamical systems with several controllers, each operating on the system with partial information on the states of the systems. In certain cases, this restriction amounts to certain structural constraints on the feedback control matrices. With the constraints, controllability of the systems does no longer imply stabilizability. Algebraic and geometric approaches are used to obtain stabilizability conditions for decentralized systems. Author (GRA)

N71-21517# Stanford Univ., Calif. Dept. of Statistics.
EFFICIENT ESTIMATION OF REGRESSION COEFFICIENTS IN TIME SERIES
Theodore W. Anderson 1 Oct. 1970 25 p refs
(Contract N00014-67-A-0112-0030)
(AD-716955; TR-2) Avail: NTIS CSCL 12/1

Problems of efficient estimation are considered in the model in which the T-component observable random vector y has expected value Z beta, where Z is a T x p matrix of known numbers of rank p(= or < T) and beta is a p-component vector of regression coefficients, and (nonsingular) covariance matrix sigma. The least squares estimate of beta is identical to the Markov or Best Linear Unbiased Estimate if and only if the p columns of Z are linearly independent linear combinations of p linearly independent characteristic vectors of sigma. The proof uses the covariance matrices of the estimates. When the components constitute time series such that sigma corresponds to a stochastic process stationary in the wide sense, the limits of the appropriately normalized covariance matrices of the two estimates are considered as T approaches infinity. Author (GRA)

N71-21518# Stanford Univ., Calif. Dept. of Statistics.
UNBIASEDNESS OF TESTS FOR HOMOGENEITY OF VARIANCES
Arthur Cohen and William E. Strawderman 8 Dec. 1970 15 p refs
(Contract N00014-67-A-0112-0053)
(AD-716957; TR-168) Avail: NTIS CSCL 12/1

Consider the classical homogeneity of variances model. That is, suppose one has a one way layout, with independent random samples of equal sizes in each column. Assume the samples are from normal populations with unknown means and unknown variances. One wishes to test the hypothesis that all the variances are equal. R. V. Laue (1965) defined a two parameter family of statistics to test the homogeneity hypothesis. The family is defined as a function of the ratio of mean value functions of the sample variances. Included in the family are many of the well known tests for homogeneity. In this paper the authors investigate which of the tests is unbiased. Although the authors are unable to resolve the question for every test in the family, they can demostrate the unbiased character for several subfamilies, which include some of the better known tests. Author (GRA)

N71-21533# Laboratorie de Physique Theorique et des Hautes Energies, Orsay (France).
CORRELATION INEQUALITIES ON SOME PARTIALLY ORDERED SETS
C. M. Fortuin, J. Ginibre, and P. W. Kasteleyn Jan. 1971 21 p refs
(LPTHE-71/3) Avail: NTIS

The proof that increasing functions on a finite distributive lattice are positively correlated by positive measures satisfying a suitable convexity property is presented. Applications to Ising ferromagnets in an arbitrary magnetic field and to the random cluster model are given. Author

N71-21566# Stanford Univ., Calif. Dept. of Statistics.
CONSISTENCY AND ASYMPTOTIC NORMALITY OF TWO PHASE REGRESSION MAXIMUM LIKELIHOOD ESTIMATES
D. V. Hinkley 13 Dec. 1970 15 p refs
(Contract N00014-67-A-0112-0053)
(AD-716959; TR-169) Avail: NTIS CSCL 12/1

Consistency and asymptotic normality are established for the maximum likelihood estimates of parameters in the two-phase regression model. Author (GRA)

N71-21567# California Univ., Los Angeles. School of Engineering and Applied Science.
ON APPROXIMATE INPUT SIGNAL SYNTHESIS IN PLANT PARAMETER IDENTIFICATION
Masanao Aoki and R. M. Staley (TRW Systems, Redondo Beach, Calif.) 11 Dec. 1970 5 p refs
(Grant AF-AFOSR-1328-67)
(AD-716923; AFOSR-70-2893TR) Avail: NTIS CSCL 12/1

The paper discusses a method to generate a sequence of input signals which approximately minimizes a given measure of error in identifying unknown parameters in dynamic systems governed by a difference equation. For the sake of brevity, the following discussions are on a scalar system. The method can be applied to systems described by vector difference equations. Author (GRA)

N71-21570# Stanford Univ., Calif. Dept. of Statistics.
THE SELECTION OF EFFECTIVE ATTRIBUTES FOR DECIDING BETWEEN HYPOTHESES USING LINEAR DISCRIMINANT FUNCTIONS
Herman Chernoff 15 Dec. 1970 12 p refs

(Contract N00014-67-A-0112-0051)
(AD-716956; TR-68) Avail: NTIS CSCL 12/1

Let X be a multidimensional random variable, whose components are called attributes, with mean mu sub i and covariance matrix Sigma sub i under H sub i, i = 1,2. The ability to discriminate between H sub 1 and H sub 2 using a linear discriminant function is measured. As a consequence of a result of Anderson and Bahadur, it is seen that the problem of selecting additional variables or attributes involves increasing the Mahalanobis distance, where delta = mu sub 1 − mu sub 2 and Sigma is an appropriate weighted average of Sigma sub 1 and Sigma sub 2. The problem discussed is related to problems in regression theory. Some simple examples illustrate that if Sigma sub 1 is in some sense much smaller than Sigma sub 2, there is a premium on adjoining additional attributes for which the variance under H sub 1 is relatively small.
GRA

N71-21572*# Texas Univ., Austin. Applied Mechanics Research Lab.
AUTOMATED, CLOSED FORM INTEGRATION OF FORMULAS IN ELLIPTIC MOTION
William H. Jefferys Aug. 1970 12 p refs
(Grant NGR-44-012-046)
(NASA-CR-114965; AMRL-1020) Avail: NTIS CSCL 12A

In some perturbation theories it is possible to avoid expansion of the perturbations in powers of the eccentricity, obtaining results in closed form by using the true or eccentric anomaly instead of the mean anomaly. An algorithm (which has been programmed for the 6600 computer using the formula manipulation system TRIGMAN) for automatically performing the integrals which arise in these theories is described.
Author

N71-21573*# Texas Univ., Austin. Applied Mechanics Research Lab.
A MODIFIED SWEEP METHOD FOR CONTROL OPTIMIZATION
Daniel Colunga May 1970 124 p refs
(Contract NAS9-9903)
(NASA-CR-114964; AMRL-1016) Avail: NTIS CSCL 12A

Optimal control of spacecraft trajectories requires obtaining an optimal (maximum or minimum) value for an appropriate scalar quantity. This scalar quantity measures spacecraft performance and is called the performance index. In addition, terminal conditions such as might be specified for intercept or rendezvous problems must often be satisfied simultaneously. After the problem has been formulated mathematically, several conceptual approaches are available to obtain the conditions required to solve the optimization problem. Among the more usual approaches are the calculus-of-variations, dynamic programming, and Pontryagin's Principle. The calculus-of-variations is considered here because specific optimal control problems can be considered as particular cases of the more generalized Bolza problem of the classical calculus-of-variations. The powerful results associated with this classical theory thus are available for attacking optimal control problems.
Author

N71-21578# University of Southern Calif., Los Angeles.
DIFFERENTIAL QUADRATURE AND LONG TERM INTEGRATION
Richard Bellman and John Casti (RAND Corp., Santa Monica, Calif.) Jan. 1970 5 p refs Prepared in cooperation with RAND Corp., Santa Monica, Calif.
(Contract AT(11-1)-113; Grant NSF GP-8960)
(TID-25616; TR-70-9) Avail: NTIS

A technique is described for the numerical solution of initial value problems for ordinary and partial differential equations with particular relevance to questions arising from long-term integration.
Author

N71-21626# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
ON ADDITION CHAINS
Hatsuhiko Kato Jan. 1970 67 p refs
(Contaact AT(11-1)-113; Grant NSF GP-8960)
(TID-25620; TR-70-8) Avail: NTIS

An addition chain is a sequence of positive integers which provides an optimal procedure for obtaining a power of an associative operator. The emphasis in the study is on deriving feasible algorithms for finding suboptimal chains. Various methods are described and compared with respect to both memory requirement and computation time. Fibonacci sequences and binary sequences are studied together with several variations. Extensive use of the computer is made to assist the theoretical work. Direct application of the results to power raising algorithms are given and some associated uses of the idea are discussed. Some generalizations of an addition chain are briefly mentioned; a multidimensional case, a complementary method, and a three-register case. Some related problems, including the postage stamp problem and matrix multiplication are also considered.
Author

N71-21662# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering and Mathematics and Medicine.
FUNCTIONAL EQUATIONS IN THE THEORY OF DYNAMIC PROGRAMMING. 18: MINIMUM CONVOLUTIONS AND GREEN'S FUNCTIONS
Richard Bellman Jan. 1970 4 p refs
(Contract AT(11-1)-113; Grant NSF GP-8960)
(TID-25612; TR-70-4) Avail: NTIS

The minimization of the functional J(u) = the integral from S to T of q(u,u',t)dt is considered for the quadratic case, the analytic case, and the two-dimensional case. It is pointed out that often the use of the functional equations is preferred to that of the Riccati equation.
N.E.N.

N71-21675# Stanford Univ., Calif. Dept. of Statistics.
ON THE EXISTENCE OF PROPER BAYES MINIMAX ESTIMATORS OF THE MEAN OF A MULTIVARIATE NORMAL DISTRIBUTION
William E. Strawderman 4 Jan. 1971 13 p refs
(Contract N00014-67-A-0112-0053)
(AD-716958; TR-170) Avail: NTIS CSCL 12/1

Consider the problem of estimating the mean of a multivariate normal distribution with convariance matrix as the identity and sum of squared errors loss. In an earlier paper the author showed that if the dimension p is 5 or greater, then proper Bayes minimax estimators do exist. This result is reviewed briefly. The main purpose of the present paper is to show for p equal to 3 or 4, that there do not exist spherically symmetric proper Bayes minimax estimators. The author has been unable, thus far, to disprove the existence of a nonspherical proper Bayes minimax estimator for p equal 3 or 4. Of course, for p = 1,2, the usual estimator X bar is unique minimax but not proper Bayes. Bounds are derived for the possible bias of a minimax estimator. This result should be of some interest independent of its use in proving the main result of the paper.
Author (GRA)

N71-21680# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
ONE SWEEP NUMERICAL METHOD FOR VECTOR-MATRIX DIFFERENCE EQUATIONS WITH TWO-POINT BOUNDARY CONDITIONS
E. Angel and R. Kalaba Apr. 1970 16 p refs
Contract AT(11-1)-113; Grants NIH GM-16197-01; NIH GM-16437-01)
(TID-25609; TR-70-16) Avail: NTIS

An invariant imbedding method is proposed for reducing two point boundary value problems for vector-matrix systems of

linear difference equations to initial value problems. The method has the advantage that only one sweep is required, and memory requirements are minimal. Applications to potential theory are discussed. Author

N71-21681# Stanford Univ., Calif. Dept. of Computer Science.
PARALLEL PROCESSING WITH THE PERFECT SHUFFLE
Harold S. Stone Mar. 1970 36 p refs
(Contract AT(04-3)-26)
(STAN-CS-70-158-App-5) Avail: NTIS

Given a vector of N elements, the perfect shuffle of this vector is a vector in which the elements are arranged as if the elements were cards in a deck that had undergone a perfect shuffle. That is, the shuffled vector alternates between elements from the first N/2 components and the last N/2 components of the unshuffled vector. By a series of examples, it is shown that the perfect shuffle is an important interconnection pattern for a parallel processor. The examples include the Fast Fourier Transform, polynomial evaluation, sorting, and matrix transposition. For the FFT and sorting, the rate of growth of computational steps for algorithms that use the perfect shuffle is the least known today, and is somewhat better than the best rate that is known for versions of these algorithms that use the interconnection scheme used in the Illiac IV. Author

N71-21682# Los Alamos Scientific Lab., N.Mex.
STATISTICAL EFFECTS OF DECONVOLUTION
B. R. Hunt Dec. 1970 37 p refs
(Contract W-7405-eng-36)
(LA-4556-MS) Avail: NTIS

The problem of deconvolution is considered. It is shown that the straightforward solution of deconvolution problems by means of the discrete Fourier transform is equivalent to the least-squares solution of an ill-conditioned linear regression problem, which results in large variances in the estimated values for the solution. A technique proposed for solving integral equations is reviewed and it is shown that the satisfactory properties of this technique are due to the reduced variance obtainable with a biased estimate. The diacrete Fourier tranform is used to prove many of the results and is also useful for demonstrating efficient computation of the solution and the statistical properties of the solution to the deconvolution problem. Author

N71-21685# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
AN APPROACH TO THE SEPARATION OF CONTROL AND ESTIMATION FOR NONLINEAR STOCHASTIC SYSTEMS
Richard Gran Mar. 1971 13 p refs Presented at the IEEE Symp. on Nonlinear Estimation Theory and its Application, San Diego, 21 – 23 Sep. 1970
(RM-500J) Avail: NTIS

Some of the problems one encounters in attempting to seperate control and estimation in a nonlinear system are discussed. One particular system, which is linear with nonlinear controls and nonlinear measurement dynamics, is shown to be separable. Author

N71-21730# Hawaii Univ., Honolulu.
ASSIGNMENT OF A REVERSIBLE LANE: AN EXAMPLE OF OPTIMAL CONTROL Interim Report
R. Chattopadhyay Sep. 1970 10 p ref
(Contract F44620-69-C-0030; Grant NSF GK-4984; Proj. Themis)
(AD-717207; THEMIS-A70-15; AFOSR-70-2887TR) Avail: NTIS CSCL 12/1

The document discusses the problem of optimum assignment of a reversible lane in an oversaturated two-way traffic link from a control-theoretic viewpoint. State space trajectories are used to solve the optimization problem. It is hoped that the simple problem considered here will stimulate further applications of control theory to traffic system analysis. Author (GRA)

N71-21794# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
USE OF SPLINES WITH UNKNOWN END POINTS IN THE IDENTIFICATION OF SYSTEMS
Richard Bellman and Robert S. Roth (Avco Corp., Wilmington, Mass.) Jan. 1971 11 p refs Prepared in cooperation with Avco Corp., Wilmington, Mass.
(Contract AT(11-1)-113; Grant NSF GP-8960)
(TID-25617; TR-70-6) Avail: NTIS

Techniques were developed to cope with identification problems which involve a blend of quasilinearization and dynamic programming. A method was suggested to circumvent the quasilinear techniques which have certain inherent computational difficulties. Fitting the observed experimental data with a known function and using this data fit to determine the properties of the system parameters is explored. The cubic spline was chosen as the data fitting function. Author

N71-21810# Stanford Univ., Calif. Dept. of Computer Science.
SCHEDULING OF N TASKS WITH M OPERATIONS ON TWO PROCESSORS. APPENDIX 2
Henry Bauer and Harold Stone Jul. 1970 34 p refs
(Contract AT(04-3)-326; Grant NSF GJ-687)
(STAN-CS-70-165-App-2) Avail: NTIS

A discussion of the problem of scheduling N tasks on two processors when each task consists of three operations is presented. The operations of each task must be performed in order and among the processors. This problem is analyzed through four subproblems. Johnson's scheduling algorithm is generalized to solve two of these subproblems, and functional equation algorithms are used to solve the remaining two problems. Except for one case, the algorithms are efficient. The exceptional case has been labelled the core problem and the difficulties are described. Author

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N71-20645# Air Weather Service, Scott AFB, Ill.
THE USE OF TRAJECTORIES IN TERMINAL FORECASTING
John W. Diercks Nov. 1970 34 p refs
(AD-716811; AWS-TR-237; Rept-2) Avail: NTIS CSCL 4/2

Trajectory forecasting techniques have been introduced at 75 Air Weather Service forecast units. Trajectory data, in the form of parcel origins and forecast temperatures, dew points, and cloud amounts, are transmitted twice daily to these forecast units. These data are a by-product of the Air Force Global Weather Centrals (AFGWC) Multi-Level Cloud-Forecasting Model and are used to supplement conventional forecast tools. In addition, 600-meter (above ground level) temperature and dew-point forecasts from AFGWCs Boundary-Layer Model are included in the trajectory bulletin. Trajectory techniques have been integrated subjectively and objectively into forecast procedures with encouraging results. Ceiling and visibility forecasts prepared with trajectory data have verified better than forecasts prepared without trajectory data. This report discusses past evaluation programs, characteristics of the trajectory model, and procedures for using the data in forecast applications. Author (GRA)

N71-20646# Illinois State Water Survey, Urbana.
STUDY OF RAINOUT OF RADIOACTIVITY IN ILLINOIS

Progress Report, Nov. 1970
Richard G. Semonin Nov. 1970 40 p refs
(Contract AT(11-1)-1199)
(COO-1199-19; PR-9) Avail: NTIS

The tracer experiment was conducted during May and June of 1970 to study rainout of radioactivity. Field experiments involved putting indium and/or lithium, contained in aircraft-borne flares, into prescribed parts of thunderstorm clouds, collecting rainwater samples from those clouds, and analyzing the storm rainwater for the tracers. Data on the cloud core parameters and preliminary data into the clouds are presented. Laboratory studies were conducted to determine the scavenging of atmospheric particles by rain. The results show that the smallest drops have the greatest scavenging efficiency, and that, for a given size drop, the scavenging efficiency increases with increased electrical charge. NSA

N71-20764# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
USE OF STATISTICAL METHODS IN METEOROLOGY: SELECTED ARTICLES [PRIMENENIE STATISTICHESKIKH METODOV V METEOROLOGII]
L. S. Gandin et al 30 Oct. 1970 179 p refs Transl. into ENGLISH from Glavnaya Geofizicheskaya Observ. (Leningrad), no. 191, 1966 179 p
(AD-716939; FTD-MT-24-175-70) Avail: NTIS CSCL 4/2

Contents: Concerning the question of approximation of characteristics of statistical structure; Statistical structure of the precipitation field; Certain characteristics of the three-dimensional macrostructure of air temperature; Three-dimensional objective analysis of the field of air temperature; The effect of instrument inertia on the accuracy of meteorological measurements; Optimum formulas for numerical quadratures for random functions of a special type; One method of restoration of the geopotential field of the 500 millibar surface; Statistical structure of averaged values of meteorological elements; Correlation functions for a case of exponential structure (two-dimensional averaging); Correlation functions for a case of power structure; The problem of the accuracy of analysis of synoptic maps. GRA

N71-20786# Istituto di Fisica dell Atmosfera, Rome (Italy).
HAILSTORM STUDIES AT THE OBSERVATORY OF THE INSTITUTE FOR ATMOSPHERIC PHYSICS, VERONA, 1969
G. M. Morgan, Jr. Mar. 1970 102 p refs Sponsored by Min. of Agr. and Forests
(IFA-TR-31) Avail: NTIS

The hailstorms in Italy observed at Verona Observatory for 1969 are studied. The hail and thunderstorms in Northern Italy during 1969 are reviewed with emphasis on the wind and hail in the Po valley on 15 – 16 August and the hailstorm on 8 – 9 July. The radar data are interpreted and the detection of hailstorms by radar is described. Finally the effects of lakes and other water bodies on storm development are analyzed. ESRO

N71-20806# Air Force Cambridge Research Labs., Bedford, Mass.
FOG MODIFICATION BY USE OF HELICOPTERS
Vernon G. Plank, Alfred A. Spatola, and James R. Hicks 28 Oct. 1970 164 p Prepared in cooperation with Atmospheric Sci. Lab. *Its* Environ. Res. Papers No. 335
(AD-716818; AFCRL-70-0593; ECOM-5339) Avail: NTIS CSCL 4/2

Results of helicopter clearing experiments conducted at the Greenbrier Valley Airport, Lewisburg, West Virginia, during the period 7 to 29 Sep 1969, are presented and discussed. Thirty-five hover experiments and runway-clearing experiments were performed on 10 separate days with fog layers ranging from 125 to 525 ft in depth. The hover experiments, which were successful in virtually all cases, yielded clearings that varied from 400 to 2800 ft in length extent. The largest clearings occurred with the shallowest fog during tests conducted within one hour or so of the natural dissipation time of the fog. The runway-clearing experiments were successful in clearing the full 6000 ft extent of the runway on two occasions, were partially successful on four occasions and were unsuccessful on 12 occasions. Six helicopter landings were accomplished through artificially-created clearings. Quantitative information is described concerning the wake penetration distances of the helicopters, the steady-state clearing times, the total entrainment (mixing) values and the persistence times of the clearings following helicopter departure from the test sites. The temperature, humidity and wind speed values within the cleared zones are also given for certain of the experiments. Author (GRA)

N71-21028# Naval Weather Service Command, Washington, D.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS: NORTH AMERICAN COASTAL MARINE AREAS. VOLUME 11: AREA 1, VANCOUVER, AREA 2, QUEEN CHARLOTTE, AREA 3, SITKA
Dec. 1970 483 p
(AD-716721) Avail: NTIS CSCL 4/2

The data contained in these tables were obtained from tape data Family 11 (TDF-11), Marine Surface observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected by NWSED Asheville as the most comprehensive collection of marine surface observations from which to develop a series of coastal marine summaries. The areas included are Vancouver and Queen Charlotte, British Columbia and Sitka, Alaska. GRA

N71-21180# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HYDROMETEOROLOGICAL SCIENTIFIC RESEARCH CENTER OF THE USSR
S. A. Bortnikov et al 13 Oct. 1970 64 p refs Transl. into ENGLISH from Tr. Gidrometeorol. Nauchno Issled. Tsentr. (USSR), no. 16, 1968 p 21 – 60
(AD-717008; FTD-MT-24-172-70) Avail: NTIS CSCL 4/2

Contents: Construction of a multilayer prediction model on the basis of an attempt at operational short-range prediction with complete equations for two levels of the atmosphere; Stability according to the initial data of numerical methods of short-range weather forecasting; Integration of the complete equations of short-range weather prediction according to explicit difference methods. GRA

N71-21198# Meteorologisches Observatorium, Hohenpeissenberg (West Germany).
DATA ON PRECIPITATION FREQUENCY AND INTENSITY AT HOHENPEISSENBERG [DATEN ZUR NIEDERSCHLAGSHAEUFIGKEIT UND -INTENSITAET AUF DEM HOHENPEISSENBERG]
Rudolf Aniol Oct. 1970 27 p refs In GERMAN *Its* Sonderbeobachtungen No. 10
Avail: NTIS

Tables are given of the quantity and frequency of precipitation at the Hohenpeissenberg Meteorological Observatory (Germany) during the years 1879 to 1968 (excluding 1 April to 14 May 1945). ESRO

N71-21241 Missouri Univ., Columbia.
EFFECTS OF ENVIRONMENTAL FLOW BETWEEN ADJACENT THUNDERSTORMS
Ralph Elliott Pendleton (Ph.D. Thesis) 1969 100 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 70-6623

Evidence is presented to show that dynamic pressure gradients induced by the flow of environmental air between thunderstorms' cells may influence the motion and severity of these storms. Flows

around solid cylinders in a water channel and potential flows are compared with observed flows on the flanks of thunderstorms. From this comparison it is shown that the flow on the flanks of some thunderstorms is very close to that predicted by potential flow theory. Numerical integrations using upper air soundings in the vicinity of a group of severe storms and an assumed potential flow are used to illustrate the relative influence of storm movement, rotation and separation between adjacent cells. Deviation of storms from the mean relative wind direction is found to increase the convection on the flanks due to the greater dynamic pressure gradients induced by the stronger relative winds incident on these storms. On the basis of the above computations and the observed behavior of many storms, a process is described to account for the observed convergence and severity of many merged cells. Dissert. Abstr.

N71-21242# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INVESTIGATION OF THE STRUCTURE OF AIR CURRENTS

N. Z. Pinus 23 Sep. 1970 25 p refs Transl. into ENGLISH from Tsent Aerologicheskaya Observatoriya, Trudy (USSR), no. 90, 1969 p 30-40

(AD-717052; FTD-MT-24-168-70) Avail: NTIS CSCL 4/1

The article is a review of experimental studies of the structure of air currents made at the Central Aerological Observatory. Emphasis is on a study of data on the structure of jet streams, variability of wind velocity and direction in the troposphere and stratosphere and turbulence over plains and mountains and in a zone of well-developed cumulonimbus clouds. Data are given on the spectral characteristics of fluctuations of the vertical and horizontal components of wind velocity, dependence of the form of energy spectra on thermal and dynamic stratification of the atmosphere and some other factors. The tasks for the next investigations are formulated. Author (GRA)

N71-21243# Environmental Technical Applications Center (Air Force), Washington, D.C.

A SELECTED ANNOTATED BIBLIOGRAPHY OF ENVIRONMENTAL STUDIES OF ARGENTINA, CHILE, AND URUGUAY

Vincent J. Cresi Dec. 1970 47 p refs

(AD-717196; ETAC-TN-70-10) Avail: NTIS CSCL 4/2

The bibliography was compiled as a by-product of the regular reference-searching that is one aspect of the normal workload of the Technical Information Section, USAF ETAC. Many of the abstracts herein were taken from the publications themselves, many others, or parts of abstracts, from Meteorological and Geoastrophysical Abstracts (Am. Met. Soc.), and others were prepared by members of the Technical Information Section of USAF ETAC. Author (GRA)

N71-21244# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.

HUMIDITY GENERATING APPARATUS AND MICROSCOPE CHAMBER FOR USE WITH FLOWING GAS ATMOSPHERES

Gayle S. Rinehart Oct. 1970 26 p refs

(AD-716994; ECOM-5332) Avail: NTIS CSCL 4/2

A humidity generating apparatus and an atmospheric control chamber to be used with an optical microscope are described. The humidity generating apparatus simply provides for a mixing of wet and dry air by means of a gas proportioner. The chamber is designed to accommodate a standard microscope slide as the chamber floor. While the slide is in the chamber, changes in the specimen with variations in the humidity of a flowing atmosphere can be observed with an optical microscope. Author (GRA)

N71-21245# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.

IMPACT DEFLECTION ESTIMATORS FROM SINGLE WIND MEASUREMENTS

Walter B. Miller, Abel J. Blanco, and L. E. Traylor Sep. 1970 48 p refs

(AD-716993; ECOM-5328) Avail: NTIS CSCL 4/2

A statistical examination is made of the power law formula currently in use to extrapolate a wind profile from a single measurement near the surface to the burnout altitude of the M50 Honest John rocket (400 mil Q.E.) for the purpose of obtaining low-level wind corrections to the launcher settings. Two new statistical wind displacement estimators are developed which provide from 40% to 60% reduction in dispersion due to low-level wind based on simulated rocket trajectories utilizing actual wind profiles. Author (GRA)

N71-21271# TUAB Teleutredningar A.B., Solna (Sweden). Space Technology Group.

THE K69/1 CAMPAIGN AT ESRANGE IN JANUARY 1969 Final Report

S. Lundin 17 Nov. 1970 14 p refs Sponsored in part by Sci. Res. Council

(Rept-S4-K69/1-24) Avail: NTIS

An account is given of the cooperative sounding rocket campaign conducted by SSRC, BSRC, and NASA which was to study the temperature and winds at high altitude during a sudden stratospheric warming. The payloads, experiments, and results are described and a summary of firings given. ESRO

N71-21293 California Univ., Berkeley.

THE EARTH'S ATMOSPHERIC TEMPERATURE PROFILE FROM A GROUND BASED MEASUREMENT OF OXYGEN MICROWAVE EMISSION

Gayle Fred Miner (Ph.D. Thesis) 1969 189 p

Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 70-6171

The determination of the tropospheric temperature profile utilizing a measurement of the vertical ground brightness temperature spectrum due to the microwave emission of atmospheric oxygen and water vapor is described. Results of brightness temperature measurements made in the 50 - 60 GHz frequency range are given and compared with theoretical values obtained by applying the radiative transfer integral equation to the weather bureau radiosonde atmospheres obtained concurrently. Applications of the radiometer brightness temperature measurements are made in a statistical estimation method for inverting the integral equation to infer the atmospheric temperature profile. The derived temperature profiles and the radiosonde temperature profiles are compared, and it is shown that the derived profiles are closer to the actual profiles than an average daily temperature profile of past radiosonde measurements. Dissert. Abstr.

N71-21468*# Colorado State Univ., Fort Collins.

METEOROLOGICAL APPLICATION OF APOLLO PHOTOGRAPHY Final Report

C. Wooldridge, E. R. Reiter, T. H. Vonder Haar, and J. L. Rasmussen Dec. 1970 28 p refs

(Contract NAS9-10305)

(NASA-CR-114954) Avail: NTIS CSCL 04B

Meteorological research using Apollo 9 photographs is discussed. In addition, a discussion of opportunities for additional research in connection with future manned spacecraft missions is presented. These include: (1) an extension of sub-synoptic scale atmospheric wave investigations begun under the present contract, (2) a plan to obtain high accuracy measurements of the energy exchange between earth and space (the radiation budget of our planet), and (3) the opportunity to provide vital support to ongoing large-scale weather modification efforts in the western mountains. These new opportunities address significant environmental problems of the 1970's -the kind presently planned for study within the

international Global Atmospheric Research Program (GARP), by scientists concerned with worldwide effects of pollution and global climatic change, and by our national effort to productively modify certain aspects of regional weather related to hydrology. Author

N71-21484# National Weather Service, Silver Spring, Md.
NUMERICAL WEATHER PREDICTION ACTIVITIES, NATIONAL METEOROLOGICAL CENTER, SECOND HALF OF 1970
Mar. 1971 44 p refs
Avail: NTIS

The activities of the Numerical Forecasting Center for the reporting period are presented. Some included topics are: revisions in the operational program, data automation, forecast verifications, machine performance and utilization. F.O.S.

N71-21513*# Environmental Data Service, Asheville, N.C. National Climatic Center.
SURFACE CLIMATOLOGICAL INFORMATION: TWENTY SELECTED STATIONS FOR SPACE SHUTTLE STUDIES
G. W. Goodge, T. H. Bilton, and F. T. Quinlan 18 Mar. 1971 178 p ref
(NASA-Order H-76789-OMSF)
(NASA-CR-61342) Avail: NTIS CSCL 04B

Space Shuttle studies require surface climatological information for advanced planning in the design, operation, and site selection areas. Selected climatological summaries are presented for twenty United States locations; two of which are in Alaska. A short narrative precedes the tabular summaries. Monthly and annual temperature-precipitation summaries are given. The monthly and annual summaries of specified weather conditions are also shown. A few ceiling/visibility combinations from near minimum to good landing conditions are included in the specified weather conditions. The final summaries presented are wind rose tabulations. Author

N71-21521# Finnish Meteorological Office, Helsinki.
AERONAUTICAL CLIMATOLOGICAL CONDITIONS AT ROVANIEMI AERODROME
Ilona Soini 1970 38 p refs
(Rept-28) Avail: NTIS

Aeronautical climatological tables are presented which agree with ICAO and WMO international regulations. Climatological tables included are prepared according to WMO summary models A, B, and C. Tables of distributions of dry bulb temperatures and hydrometeors are also given. Some of the distributions are also in graphical form. Author

N71-21537# Finnish Meteorological Office, Helsinki.
AERONAUTICAL CLIMATOLOGICAL CONDITIONS AT MAARIANHAMINA AERODROME
Ilona Soini 1970 39 p refs
(Rept-26) Avail: NTIS

Aeronautical climatological tables are presented which agree with ICAO and WMO international regulations. Climatological tables included are prepared according to WMO summary models A, B, and C. Tables of distributions of dry bulb temperatures and hydrometeors are also given. Some of the distributions are also in graphical form. Author

N71-21538# Finnish Meteorological Office, Helsinki.
AERONAUTICAL CLIMATOLOGICAL CONDITIONS AT VASSA AERODROME
Ilona Soini 1970 39 p refs
(Rept-30) Avail: NTIS

Aeronautical climatological tables are presented which agree in accordance with ICAO and WMO international regulations. Climatological tables included are prepared according to WMO summary models A, B, and C. Tables of distributions of dry bulb temperatures and hydrometeors are also given. Some of the distributions are also in graphical form. Author

N71-21539# Finnish Meteorological Office, Helsinki.
AERONAUTICAL CLIMATOLOGICAL CONDITIONS AT TURKU AERODROME
Ilona Soini 1970 38 p refs
(Rept-29) Avail: NTIS

Aeronautical climatological tables are presented which agree with ICAO and WMO international regulations. Climatological tables included are prepared according to WMO summary models A, B, and C. Tables of distributions of dry bulb temperatures and hydrometeors are also given. Some of the distributions are also in graphical form. Author

N71-21540# Finnish Meteorological Office, Helsinki.
AERONAUTICAL CLIMATOLOGICAL CONDITIONS AT OULU AERODROME
Ilona Soini 1970 39 p refs
(Rept-27) Avail: NTIS

Aeronautical climatological tables are presented which agree with ICAO and WMO international regulations. Climatological tables included are prepared according to WMO summary models A, B, and C. Tables of distributions of dry bulb temperatures and hydrometeors are also given. Some of the distributions are also in graphical form. Author

N71-21593# Wisconsin Univ., Madison. Dept. of Meteorology.
STUDIES OF BOUNDARY-LAYER PARAMETERS Final Report
Heinz H. Lettau, Charles R. Stearns, and Kenneth MacKay Jul. 1970 85 p refs
(Contract DAEA18-69-C-0082)
(AD-716988; ECOM-0082-F) Avail: NTIS CSCL 4/2

Theoretical developments are used to show that the ratio of the eddy diffusivity for sensible heat to that for momentum may be equal to one only near adiabatic conditions where coherence and Karmen similarity may be assumed. Measurements made under intermittant or noncoherent conditions are shown to yield fictitious estimates of the eddy diffusivity ratio. The aerodynamic estimates of latent heat flux density and surface stress are compared to independent estimates using shear-stress and evaportranspiration lysimeters and an assumption about the variation of the eddy diffusivity ratios. The influence of the diurnal heating cycle on the diurnal geostrophic wind oscillations is developed and compared to observations. Author (GRA)

N71-21617# Alaska Univ., College. Geophysical Inst.
STUDIES ON ICE FOG Final Report
Takeshi Ohtake Jun. 1970 204 p refs
(Contract PHS-AP-00449)
(PB-196977; UAG-R-211; APTD-0626) Avail: NTIS CSCL 04B

In order to clarify the mechanism of ice fog formation, various atmospheric factors in ice fogs such as size and concentration of ice fog crystals, condensation nuclei and ice nuclei, amount of water vapor, temperature profile near the sources of ice fog, etc. were measured. Nuclei of the ice fog crystals were studied by use of an electron microscope and electron diffraction. Most nuclei of ice-fog crystals were combustion by-products and many individual crystals collected near open water did not have a nucleus, especially at temperatures below 40C. Dust particles or particles from air pollution are not essential for formation of ice fog; they merely stimulate freezing of water droplets at higher temperature. The essential factor is to first form many water droplets in the atmosphere through condensation of water vapor. Author (GRA)

N71-21618# Utah State Univ., Logan. Water Research Lab.
INSTRUMENTATION AND DEVELOPMENT OF TECHNIQUES TO MEASURE AND EVALUATE METEOROLOGICAL PARAMETERS IMPORTANT TO HYDROLOGY, 1 JULY 1967 - 30 JUNE 1970
Duane G. Chadwick 1 Nov. 1970 50 p refs
(Congract DI-14-0001-1865)
(PB-196726; PRCWRR12-1) Avail: NTIS CSCL 04B

A hydrologic data telemetering system was designed to have the highest accuracy of any FM/FM telemetering system known. The repeatability of readout approaches 0.05%. This high accuracy is obtained by: (1) a frictionless transducer; (2) a specially designed tracking filter; (3) a wide-range frequency deviation of plus or minus 40% permitting greater resolution and accuracy; (4) readout subsequently converted to usable units by aid of a digital computer, and (5) locating the electronics and the transducer in a temperature stable environment, underground. The frictionless transducer technique was used in developing a low-displacement pressure transducer for measuring the water-content of snow. A method was developed for the automatic plotting of isohyetal lines on an analog computer. Author (GRA)

N71-21619# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
THE MEASUREMENT OF HEAT FLOW IN THE GROUND AND THE THEORY OF HEAT FLUX METERS
Peter Schwerdtfeger Nov. 1970 37 p refs
(AD-717027; CRREL-TR-232) Avail: NTIS CSCL 4/2

The behavior of heat flux meters has been examined by experimental, electrical analogue and numerical means. The results indicate the more general applicability of the flux meter equation first proposed by Philip (1961) for the special case of spheroidal meters, provided certain precautions are taken. The purely geometric parameter appearing in this equation has been related to meter shape and a functional connection has been suggested. It is proposed that pairs of thermal sensors be used to monitor thermal conductivity continuously and the use of nonuniform focusing heat flux meters is recommended in cases where the physical cross section of a thermopile should remain small compared to the resultant thermal cross section. Finally a number of calibration techniques are reported, including the use of a novel radiation enclosure in which meters are temporarily tested as net radiometers, (Author). GRA

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N71-20686# National Aviation Facilities Experimental Center, Atlantic City, N.J.
VORLOC 2 FAR PART 171 COMPLIANCE TEST Final Report, Mar. - Sep. 1970
Frederick W. Marschall Apr. 1971 65 p
(FAA-RD-71-12; FAA-NA-71-5) Avail: NTIS

A low cost simplified directional approach system called VORLOC was developed. The equipment was examined by the Federal Aviation Administration as part of an effort to determine the acceptability of VORLOC 2 as a non-federal IFR aid for public use. This examination consisted of performing tests to gather data relative to the requirements of part 171, subpart F, of the Federal Aviation Regulations. Test data were also obtained on the effect of environmental factors on elements of the system. The tests are described and the resulting data are presented in graphs and tables. Author

N71-20765# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A DIGITAL COMPUTING DEVICE FOR AN INERTIAL NAVIGATION SYSTEM
V. O. Storozhenko et al 28 Oct. 1970 10 p refs Transl. into ENGLISH from Dopov. Akad. Nauk Ukr. RSR, Ser. A, F.-T. M. N. (Kiev), v. 29, no. 9, 1967 p 827-829
(AD-717058; FTD-HC-23-1504-68) Avail: NTIS CSCL 9/2

The operation of a computer serving an inertial navigation system with stabilization in the horizontal plane requires the solution of a system of three nonlinear differential equations involving, as variables, the latitude and longitude of the moving object, and the angle which characterizes the position of the plane in the azimuth with respect to the geographical system of coordinates. Unfortunately, a computer designed to deal directly with these equations involves a number of technical difficulties leading to substantial errors. By introducing the Rodrigues-Hamilton parameters, the author reduces the computing function essentially to the solution of four linear differential equations equivalent to the original system. One apparent advantage of a computer so designed is that no shift to a second coordinate system is required in the case of navigation near the poles. Author (GRA)

N71-20774# Lincoln Lab., Mass. Inst. of Tech., Lexington.
AIR TRAFFIC CONTROL Quarterly Technical Summary, 1 Aug. - 31 Oct. 1970
Herbert G. Weiss 15 Nov. 1970 22 p
(Contract F19628-70-C-0230)
(AD-716816; ESD-TR-70-352) Avail: NTIS CSCL 17/7

The report covers the development of improved surveillance and communication subsystems to meet the demands of the automated NAS/ARTS Air Traffic Control system. Field measurements of the beacon interference environment were completed and studies to upgrade sensor efficiency were intensified. Effort toward the development of a discrete address interrogator with a data link was concentrated upon the core problem of designing the signaling waveforms for both up and down links of the system. Particular attention is being given to system performance in the interference and multipath environment, as well as to system and equipment compatibility with ATCRBS. The project to develop an airborne situation display of NAS/ARTS data has reached the stage for definition of an experimental system. The computer simulated cockpit display has evoked enthusiastic response from experienced pilots and traffic controllers. Preliminary work on the laser beam warning system for Logan Airport was completed with successful demonstration of the prototype hardware in the Laboratory. Author (GRA)

N71-20922# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A DISCUSSION OF THE CONTROL SYSTEMS OF BALLISTIC ROCKETS
Kuang-Ch'u I 11 Sep. 1970 9 p Transl. into ENGLISH from Hang K'ung Chih Shih (Mainland China), no. 4, 1960 p 1-2
(AD-717096; FTD-HT-23-575-70) Avail: NTIS CSCL 16/4

Russia launched two multistage ballistic missiles in 1960. The deviation of the landing point with respect to trajectory range was only one sixth-thousandth and the deviation of speed of flight was three-one-hundred-thousandths, which indicated that a condition of high perfection had been reached in rocket control systems. The operating principles of rocket control systems were introduced. The function of rocket control systems was explained. A block diagram and three major components of the automatic stabilizer were discussed. These components are: position fixing element; amplification/conversion device and steering mechanism. Finally, speed measurement mechanisms were brought up since target accuracy is greatly influenced by errors in speed. What the author introduced was simply a concept of control system equipment. Author (GRA)

N71-21295*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MASCOT: A NEW CONCEPT IN GUIDANCE
C. D. Baker, W. E. Causey, and H. L. Ingram 15 Mar. 1971 24 p refs
(NASA-TM-X-64573) Avail: NTIS CSCL 17G

A guidance concept which permits practical realization of many heretofore unrealizable optimal guidance tasks, namely, on-board optimization of ascent trajectories through the atmosphere, self-targeting, optimal rendezvous, optimal coast-burn-coast-burn orbital transfer, and reentry for high lift-to-drag-ratio type of vehicles. This collection of techniques combined into one guidance program has been called MASCOT (Manned Shuttle Comprehensive Optimization and Targeting). Author

N71-21347*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GUIDANCE AND CONTROL ANALYSIS AND INTEGRATION
In its Space Programs Sum. No. 37-66, Vol. 3, Oct.–Nov. 1970 31 Dec. 1970 p 76–91 refs (See N71-21338 10-30)
Copyright. Avail: NTIS CSCL 17G

Optimization and reliability calculations are presented for multiple thermionic converter systems as functions of systems configurations and failure probability analysis of a 150-W power system; most reliable systems have diode configurations that are dependent upon the probabilities of open and shorted failures. Proposed is a laser obstacle detection sensor for the Mars surface vehicle that contains relatively small and few optical components and solid state electronics and has an overall weight of about 10 lb or less; its power efficiency is 10 kHz half of the time, and the required power is about 0.26 W. Also outlined are automated test techniques for guidance and control support equipments of future planetary missions and the demonstration of these techniques by computer. G.G.

N71-21348*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACECRAFT CONTROL
In its Space Programs Sum. No. 37-66, Vol. 3, Oct.–Nov. 1970 31 Dec. 1970 p 92–110 refs (See N71-21338 10-30)
Copyright. Avail: NTIS CSCL 17G

The effects of large flexible solar arrays on attitude control of solar electric powered spacecraft during the thrust phase were evaluated and the feasibility of using electric propulsion engines for attitude control as well as for the low thrust cruise phase of deep space missions was demonstrated. A dynamic analysis for an improved model of a spacecraft flexible appendage is described; the model consists of finite elements possessing mass and interconnections at points where rigid masses can be located. A digital gyro system has been developed and tested for the thermoelectric outer planet spacecraft single-axis simulator; a serial digital position information from this system is used to stabilize the digital attitude control system and to provide turn capability. Driver electronic packages for stepping motor circuit boards were developed and manufactured for the solar electric thrust vector control subsystem; the motor operates in a pulse fashion and thus saves power when stepper motor duty-cycle is low. G.G.

N71-21368# Battelle Memorial Inst., Columbus, Ohio.
MICROWAVE LANDING GUIDANCE SYSTEMS INITIAL CONCEPT VALIDATION TESTS Final Report
George T. Ruck Dec. 1970 62 p
(Contract F33615-70-C-1795)
(AD-717183; AFFDL-TR-70-156) Avail: NTIS CSCL 17/7

The report outlines in a very general sense an Air Force microwave landing guidance system concept-validation program. This is to provide the necessary background for the bulk of the report which is concerned with an identification of the critical areas of the RTCA signal format and system description, and some initial tests designed to validate some of the critical features of the RTCA format. The initial tests addressed are laboratory and field tests that can be conducted with standard laboratory equipment and/or equipment currently under procurement by AFFDL. These tests are concerned with those critical areas of the RTCA format that can be validated without flight testing and without requiring special purpose test hardware other than that which will be available early in 1971. Initial flight tests necessary for validating certain elements of the guidance system have not been specifically discussed since the initial laboratory and field tests must be conducted in order that meaningful flight test plans can be prepared and the flight test data analyzed. Some discussion is also given of the facilities required for the conduct of a validation test program. Since facility procurement often involves long lead times, the required facilities must be identified as early as possible. Author (GRA)

N71-21688* Brown Engineering Co., Inc., Huntsville, Ala.
TRIGONOMETRIC VEHICLE GUIDANCE ASSEMBLY WHICH ALIGNS THE THREE PERPENDICULAR AXES OF TWO THREE-AXES SYSTEMS Patent
Herman E. Thomason, Charles E. Lee, and Richard L. Moore, inventors, (to NASA) Issued 18 Jul. 1967 (Filed 20 Feb. 1963) 9 p Cl. 235-150.25 Sponsored by NASA
(NASA-Case-XMF-00684; US-Patent-3,331,951;
US-Patent-Appl-SN-260087) Avail: US Patent Office CSCL 17G

Electrical and electromechanical techniques are described for resolving the difference between two sets of three-axes coordinate references and providing voltages and control apparatus for bringing the coordinate references into coincidence. The improved trigonometric computation assembly for guidance systems ensures precision guidance for sophisticated space flight missions using simple components. E.C.

N71-21708* National Aeronautics and Space Administration. Langley Research Center, Langely Station, Va.
ATTITUDE CONTROL AND DAMPING SYSTEM FOR SPACECRAFT Patent
Peter R. Kruzhals and Ralph W. Will, inventors (to NASA) Issued 4 Jul. 1967 (Filed 8 Dec. 1964) 6 p Cl. 244-1
(NASA-Case-XLA-02551; US-Patent-3,329,375;
US-Patent-Appl-SN-416940) Avail: US Patent Office CSCL 17G

The utilization of momentum devices to provide an optimum fine attitude control and damping system is described. The control system will provide: (1) a system that produces torques which can be applied in any desired direction without unwanted crosscoupling effects, (2) a system in which power consumption and weight are minimized, (3) a system that has fine pointing accuracies, (4) a system in which the control command inputs to the individual momentun devices consists of direct torque or gimbal rate commands that are easy to mechanize, and (5) a system having both nonspinning and spinning modes of operation.
Official Gazette of the U.S. Patent Office

N71-21839*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IMP-1-D-4.5.5: DESCRIPTION AND SUMMARY OF QUALIFICATION TESTING OF THE IMP-1 ATTITUDE CONTROL SYSTEM AND YO-YO DESPIN SYSTEM
James R. Metzger Jan. 1971 30 p
(NASA-TM-X-65473; X-722-71-30) Avail: NTIS CSCL 17G

The Attitude Control System and the Yo-Yo Despin System is described in the flight configuration as installed on the IMP-I spacecraft. Certain pertinent and useful information is included from which the operation and performance of the systems may be determined. Both component and system testing is summarized in an effort to demonstrate compliance with safety and functional requirements and to assure flight quality systems. Problem areas and corrective actions are also included. Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N71-20605# Idaho Nuclear Corp., Idaho Falls.
SILVER ZEOLITE: IODINE ADSORPTION STUDIES Project Report, 1 Jul. – 31 Dec. 1969
Dallas T. Pence and William J. Maeck Nov. 1970 39 p refs
(Contract AT(10-1)-1230)
(IN-1363) Avail: NTIS

A program is in progress to evaluate the use of metal-exchanged zeolites for the adsorption of airborne iodine species in reactor containment cleanup systems and in the treatment of nuclear fuel processing plant off-gas streams. The test apparatus used for evaluating these materials and its operation are described. The following properties of silver zeolite, type X, are discussed: preparation from the sodium form; adsorption efficiency for methyl iodide at various face velocities, relative humidities, and temperatures; methyl iodide loading capacity, desorption characteristics, and stability. Comparison data for chemically impregnated charcoal are given. The effect of various gaseous pollutants on the elemental iodine adsorption efficiency of silver zeolite is also presented. Author (NSA)

N71-20607# General Electric Co., San Jose, Calif. Reactor Fuels and Reprocessing Dept.
ZIRCALOY CLAD UO2 FUEL ROD EVALUATION PROGRAM Quarterly Progress Report, May – Jun. 1970
F. H. Megerth, comp. Aug. 1970 52 p refs
(Contract AT(04-3)-189)
(GEAP-10217; Rept-6150-RF/RD-50; QPR-11) Avail: NTIS

The relative rod-average burnups of 41 rods were determined by gamma scanning with a germanium (lithium) detector system and counting the Cs-137 line. Diameter profiles determined on six fuel rods before and after chemically removing the deposited crud indicated rod-average crud thicknesses ranged from 0.0008 cm to 0.0017 cm and had an overall mean value of 0.0012 cm. A surface roughness, which varied in degree from rod to rod and with axial location and radial orientation on a given rod, was observed after the six rods had been decrudded. Four of the rods showed smooth, dark brown circumferential rings spaced at pellet-length intervals, and concentrations of small, blister-like protrusions arranged in a series of narrow parallel rings were noted on three rods. Neutron radiographs were taken of six rods in which possible cracks, small pit-like penetrations, small blisters, or discolored areas were noted during visual examination of the external surfaces. Nine of the fuel rods were punctured, and the contained free gases were collected. Dissert. Abstr.

N71-20608# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
MATERIALS FOR NUCLEAR REACTORS
S. H. Bush 30 Jun. 1970 30 p refs Presented at the 2d Intern. Conf. on the Sci. of Mater., Tremezzo, Italy Sponsored by AEC
(BNWL-SA-3426; CONF-700934-1) Avail: NTIS

In a system as complex as a nuclear reactor, it is difficult to present more than a cursory discussion of the materials that make up the core region. 'An overview of the principal reactor materials and some of the associated problems during reactor operation are presented. Author (NSA)

N71-20642# Stanford Univ., Calif. Dept. of Mineral Engineering.
NITRIDE FORMING REACTIONS IN LIQUID URANIUM ALLOYS AND THEIR APPLICATIONS TO THE REPROCESSING OF SPENT NUCLEAR FUELS Annual Progress Report, 1 Jun. 1969 – 1 Mar. 1970
Norman A. D. Parlee Mar. 1970 13 p refs
(Contract AT(04-3)-326)
(SU-326-P-28-X-2) Avail: NTIS

The equilibrium thermodynamics and reaction kinetics of the UN and U2N3 forming reactions in liquid U-Sn alloys are being studied. Studies elucidated equilibrium constants of the reactions, activity coefficients, interaction coefficients and free energy of dilution of U in liquid Sn. Application of the nitride precipitation study to metallurgical separations involved in nuclear fuel reprocessing was studied theoretically. NSA

N71-20643# Oak Ridge National Lab., Tenn.
PROGRESS IN ZIRCALOY CLADDING FAILURE MODES RESEARCH
P. L. Rittenhouse Dec. 1970 34 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3188) Avail: NTIS

Studies of cladding failure behavior (deformation, rupture, and embrittlement), the resulting blockage of the core coolant channels, and the effect of blockage on emergency cooling are described. Continuing programs in these areas of research are outlined. Recommendations are given for the extension of some existing programs and the initiation of new work. Author (NSA)

N71-20644# Oak Ridge National Lab., Tenn.
ORNL ISOTOPIC POWER FUELS Quarterly Report, Period Ending 30 Sep. 1970
Eugene Lamb Dec. 1970 28 p refs
(Contract W-7405-eng-26)
(ORNL-4639) Avail: NTIS

The solubility and leach rate of Cm(244)2O3 are being studied because of their importance in preventing release of radioactivity in the event of exposure of a Cm-244 isotopic power fuel to the earth's environment. Dense pellets of Cm(244)2O3 were exposed to water for four weeks in preliminary experiments. There was no apparent damage and it is believed that the rate of dissolution (by hydration) will be controlled. A means of releasing helium produced by decay in Cm(244)2O3 with a minimum loss is being studied. A study of alpha-particle damage in cermets is being made to define the effect of some of these variables on the volume % of the metal affected. A study of the effect of varying the radiation dose rate on the diffusion parameter of helium in Cm(244)2O3 has been completed. Author (NSA)

N71-20900# Oak Ridge National Lab., Tenn.
OAK RIDGE RESEARCH REACTOR Quarterly Report, Jul. – Sep. 1970
S. S. Hurt, III and W. H. Tabor 4 Dec. 1970 52 p refs
(ORNL-TM-3256) Avail: NTIS

The ORR operated at an average power level of 29.9 MW 87.3% of the time. Thirty-four fuel elements were declared spent, bringing the number for the year to 93. The average burnup (loss of U-235) for the quarter and for the year to date was 49%. The reactor was scheduled down on only seven occasions, two of which were end-of-cycle shutdowns. Unscheduled downtime (one shutdown) totaled 0.433 hours. The fission chamber preamplifier assembly for the No. 1 counting-rate channel was replaced, as was the ionization chamber for the No. 2 safety channel. The poolside facility (flat side of the reactor tank) was checked dimensionally on the inside and visually on the outside. There was no indication of dimensional changes of any consequence and no visible evidence of damage or excessive corrosion. Shim-rod-worth measurements were made when all shim-rod positions were filled with rods originally containing 167 g of U-235. Thermal fluxes in the fuel positions were measured. Author (NSA)

N71-20946# Oak Ridge National Lab., Tenn.
NEW CALCULATIONAL METHOD FOR SPACE ENERGY ANGULAR DEPENDENT REACTOR KINETICS
Harold Lebron Dodds, Jr. Jan. 1971 91 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3136) Avail: NTIS

In order to aid the interpretation of kinetic experiments in nuclear reactors, a new calculational method for solving the zero-power reactor kinetic equations in the frequency domain was developed. The algorithm that was developed is valid for either multigroup diffusion theory or discrete ordinate transport theory in one-dimensional slab geometry. The technique is explicitly designed to control truncation and round-off error problems. Results calculated using the new technique were compared with experimental results for a D2O moderated, natural-uranium fueled, subcritical assembly. The method was utilized in a theoretical investigation into the validity of using the point model to describe the subcritical kinetics of a symmetrically reflected, fast reactor. The results indicated that, in general, the point model was not valid for interpreting experimental results obtained with a detector located in the reflector and was only approximately valid for a detector located in the center of the core. Author (NSA)

N71-20947*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SHOCK, VIBRATION, AND ACCELERATION LOAD TESTS OF A SNAP-8 MOTOR DRIVEN LUBRICANT-COOLANT PUMP
A. J. Stromquist and C. L. Foss (Aerojet-Gen. Corp., Azusa, Calif.) Mar. 1971 17 p
(NASA-TM-X-52972) Avail: NTIS CSCL 18N

A lubricant-coolant pump for the SNAP-8 space power system was subjected to shock, vibration, and acceleration loads. Functional performance tests conducted before and after the test series indicated no discernible performance change. Disassembly and detailed inspection produced no evidence of life-limiting physical damage. Author

N71-20948*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY EVALUATION OF T-111 CLAD UN FUEL SPECIMENS FROM 2500 HOUR 1040 C (1900 F) LITHIUM LOOP TEST
Gordon K. Watson Mar. 1971 20 p refs
(NASA-TM-X-CR-52998) Avail: NTIS CSCL 18M

Uranium mononitride cylinders clad with tungsten-lined T-111, a tantalum alloy, were exposed at 1040 C to flowing lithium in a pumped lithium loop. Two fuel element specimens were removed after 2500 hours and evaluated. The specimens were compatible with flowing lithium based on appearance, weight change, chemistry, and metallography. Room temperature ductility tests of the T-111 cladding resulted in brittle, intergranular fractures. Ductility could be restored by heating at 1315 C for one hour in vacuum. Author

N71-21035# Battelle Memorial Inst., Columbus, Ohio.
EVALUATION OF THE APPLICABILITY OF EXISTING DATA TO THE ANALYTICAL DESCRIPTION OF A NUCLEAR REACTOR ACCIDENT Quarterly Progress Report, Jul. - Sep. 1970
Wayne A. Carbiener and Robert L. Ritzman Oct. 1970 36 p refs
(Contract W-7405-eng-92)
(BMI-1890) Avail: NTIS

Work related to the development of simplified models for estimating the effectiveness of emergency-core-cooling (ECC) systems is described. The simplified models are based on a balance between energy changes in the fuel and coolant regions during a specified time interval. PWR-FLECHT quench times at the axial mid-plane of the core were used as a basis of comparison. It was found that a simple heat balance could be used to reproduce the quench data and predict temperature turnaround times reasonably well; however, the relationship that was developed considerably overpredicted the temperature rise observed in the experiments. The two transient neutron kinetics codes, ADEP-1 and ADEP-2, were combined into a single code capable of accommodating either one- or two-dimensional analyses. Several additional features were added to ADEP to improve its versatility and efficiency. Rod-ejection accident calculations were extended to cases wherein the accidents were initiated at low power. Author (NSA)

N71-21049*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SHOCK AND VIBRATION TESTS OF A SNAP 8 MERCURY PUMP
Cecil L. O'Dear, Robert D. Follett, and Robert S. Foley (Aerojet Nucl. Systems Co.) Mar. 1971 22 p ref
(NASA-TM-X-5290; E-6231) Avail: NTIS CSCL 18N

A SNAP-8 mercury pump was vibration and shock tested to the maximum levels anticipated during its usage. The tests included random vibration, sinusoidal sweep vibration, and multiple 15 G shocks. The mechanical and structural deficiencies exposed by the tests can be remedied with minor design changes. Author

N71-21050# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
FACTORS AFFECTING THE OPTIMUM FUEL CYCLE
D. E. Deonigi and E. T. Merrill Oct. 1970 14 p Presented at the Regional Meeting of the AIChe, Richland, Wash., 23 Oct. 1970
(Contract AT(45-1)-1830)
(BNWL-SA-3605; CONF-701022-1) Avail: NTIS

Some of the fuel cycle codes which use different techniques for fuel cycle cost calculations are examined. A comparison of the codes shows that the figures used for working capital are responsible for the only variations in the calculated costs. It is shown that a theoretically optimum fuel cycle can be calculated simply by determining the fuel cycle cost resulting from fuel operating to a given exposure without regard to control requirements and system load factors. NSA

N71-21077# Westinghouse Electric Corp., Pittsburgh, Pa. Nuclear Fuel Div.
SAXTON PLUTONIUM PROJECT Quarterly Progress Report, Period Ending 30 Sep. 1970
W. R. Smalley Oct. 1970 26 p ref
(Contract AT(30-1)-3385)
(WCAP-3385-25) Avail: NTIS

The physics section of the final report Core fuel evaluation was revised to reflect corrected values of Pu-239/U-238 ratio. After the interim shutdown the Saxton reactor operated at power for approximately 22 days during the quarter. As of September 30, the cumulative energy generated in Core 3 was 2133 megawatt-days, with a total of 184 load follow cycles. The peak burnups in the loose lattice region were: (1) For peak power rod: 27,600 MWD/MTM; (2) For highest burnup rod: 37,100 MWD/MTM. One of the four rods was removed from the center 3 × 3 subassembly during the interim shutdown. The rod was transferred to the WPIF Hot Laboratory, where it was visually examined and gamma scanned. The examination revealed no evidence of swelling, hydride blisters, cracks, or other defects. Author (NSA)

N71-21084# Battelle Memorial Inst., Columbus, Ohio.
MFBR CLADDING, STRUCTURAL, AND COMPONENT MATERIALS STUDIES Quarterly Progress Report, Jul. - Sep. 1970
Donald L. Keller Oct. 1970 12 p refs

(Contract W-7405-eng-92)
(BMI-1891) Avail: NTIS

Investigations are reviewed on mechanical property design data for reactor materials and irradiation effects on cladding and structural alloys. E.C.

N71-21183# Argonne National Lab., Ill.
CATALOG OF ROD DROP AND TRANSFER FUNCTION DATA FROM EBR-2 RUNS 25 THROUGH 30A
I. A. Engen and R. W. Hyndman May 1970 73 p refs
(Contract W-31-109-ENG-38)
(ANL-7542) Avail: NTIS

Reactivity-perturbation experiments have been conducted in EBR-2 during many reactor runs. The results of the experiments conducted during runs 25 through 30A are presented here to provide a large amount of data in a compact form suitable for reference. Experimental rod-drop and oscillator methods used are discussed. The application of the results to reactor evaluation is not included. Author (NSA)

N71-21184# Bettis Atomic Power Lab., Pittsburgh, Pa.
EFFECT OF CLADDING OVALITY AND DIAMETRAL CREEP ON FUEL ROD SUPPORT SYSTEMS (LWBR DEVELOPMENT PROGRAM)
W. H. Harden, III Dec. 1970 13 p
(Contract AT(11-1)-GEN-14)
(WAPD-TM-714) Avail: NTIS

The results of a study to determine optimum grid dimple spacing in fuel rod support grids are presented. The spring movement due to rod ovality and diameter change is calculated as a function of rod orientation and dimple spacing. Author (NSA)

N71-21185# WADCO Corp., Richland, Wash.
CONDUCTIVITY CELLS FOR FLOW INDUCED VIBRATION MEASUREMENTS
G. R. Sawtelle Oct. 1970 42 p refs
(Contract AT(45-1)-2170
(WHAN-FR-21) Avail: NTIS

The development of a conductivity cell instrumentation for measuring flow induced vibrations in long, slender fuel pins is described. The design, construction and evaluation of conductivity cells and associated signal conditioning equipment are discussed in detail, providing the background for the underlying theory, operating procedure and limitations of a particular instrument, the PNL Impedance Detector. Author (NSA)

N71-21188# Argonne National Lab., Ill.
REACTOR DEVELOPMENT PROGRAM Progress Report, Nov. 1970
23 Dec. 1970 129 p refs
(Contract W-31-109-ENG-38)
(ANL-7758) Avail: NTIS

Highlights of project activities for November 1970 are summarized. Fuels, components, and physics development for the Liquid Metal Fast Breeder Reactor are described. The EBR-2 research and development programs, fuel fabrication, and operations are reviewed. General reactor fuels and materials development, physics studies, engineering development, fuel cycle chemistry, and LMFBR safety studies are reported. Operations and analyses of ZPR-3, ZPR-6, ZPR-9, and ZPPR are presented. NSA

N71-21189# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
EFFECT OF CONTINUOUS SPRAY OPERATION ON THE REMOVAL OF AEROSOLS AND GASES IN THE CONTAINMENT SYSTEMS EXPERIMENT
A. K. Postma and L. F. Coleman Dec. 1970 147 p refs
(Contract AT(45-1)-1830)
(BNWL-1485) Avail: NTIS

Results of two large scale experiments on fission product removal by sprays are reported in detail. For these two Containment Systems Experiment (CSE) tests, spraying was begun prior to injection of fission product stimulants into the gas phase. Spraying with recirculated liquid was continued for 24 hours at an average temperature of 250 F. In one of the tests the spray additive was sodium hydroxide at pH 9.4 and in the other the hydroxide was agumented by 1 wt % sodium thiosulfate. These tests showed that aerosol particles and inorganic iodine are rapidly removed from the gas phase by spray, and that the degree of removal continued to increase over the 24 hour period of spray recirculation. The methyl iodide removal rate, which was slow for caustic spray, was increased an order of magnitude by the presence of thiosulfate. The experimental results are in agreement with previously published data obtained in the Containment Systems Experiment. Author (NSA)

N71-21197# Oak Ridge National Lab., Tenn.
PREPARATION OF URANIUM MONONITRIDE PELLETS OF DIFFERING DENSITIES BY COLD PRESSING AND SINTERING
W. Siebmanns Dec. 1970 17 p refs Transl. into ENGLISH from the German Report
(ORNL-TR-2365; KFK-1049) Avail: NTIS

It is possible to remove the sintering difficulties of uranium mononitride by using a fine powder of particle size of approximately 1 to 6 microns protected against oxidation; thus avoiding a complicated technique in very pure inert gas, as well as extremely high sintering temperatures. It is important to have the correct medium particle size, but even more so, to have a convenient choice of particle distribution. The UN pellets of 95% theoretical density (TD) whose only impurity was uranium dioxide, were made by cold pressing in air and sintering in nitrogen. Pellet densities of 85 to 90% TD at 1700 to 1800 C and sintering times of 6 to 12 hrs can be obtained. Homogeneous pellets of low density can be obtained by adding uranium sesquinitride. Author (NSA)

N71-21198# Oak Ridge National Lab., Tenn.
LOW-PRESSURE DISTILLATION OF MOLTEN FLUORIDE MIXTURES: NONRADIOACTIVE TESTS FOR THE MSRE DISTILLATION EXPERIMENT
J. R. Hightower, Jr. and L. E. McNeese Jan. 1971 52 p refs
(Contract W-7405-eng-26)
(ORNL-4434) Avail: NTIS

The equipment consisted of a 48 liter feed tank, a 12 liter, one stage still reservoir, a condenser, and a 48 liter condensate receiver. The equipment was tested by processing six 48 liter batches of nonradioactive LiF - BeF2 - ZrF4 - NdF3 (65-30-5-0.3 mole %) at a temperature of 1000 C. A distillation rate of 1.5 cu ft of salt per day per square foot of vaporization surface was achieved in the nonradioactive tests. Evidences of concentration polarization and/or entrainment were noted in some runs but not in others. Automatic operation was easily maintained in each run, although certain deficiencies in the liquid level measuring devices were noted. Condensation of volatile salt components in the vacuum lines and metal deposition in the feed line to the still pot are problems needing further attention. Since a postoperational inspection of the equipment showed essentially no dimensional changes, the equipment was judged to be satisfactory for use with radioactive material. The results of these nonradioactive tests indicate that the application of distillation to MSBR fuel salt processing is feasible. Author (NSA)

N71-21199# Oak Ridge National Lab., Tenn.
PREPARATION AND HANDLING OF SALT MIXTURES FOR THE MOLTEN SALT REACTOR EXPERIMENT
James H. Shaffer Jan. 1971 41 p refs

(Contract W-7405-ent-26)
(ORNL-4616) Avail: NTIS

A molten mixture of LiF, BeF2, ZrF4, and UF4 served as the circulating fuel for the molten-salt reactor experiment. Its secondary coolant for transferring heat to an air cooled radiator was a molten mixture of LiF and BeF2. A third mixture that was chemically identical to the coolant mixture was used in place of the fuel for prenuclear operations and subsequently to flush the reactor core after a fuel drain. Approximately 26,000 lb of these fused fluoride mixtures were prepared from component fluoride salts and loaded into the reactor facility. Techniques for handling molten fluorides and their production process for attaining high chemical purity were developed and applied simultaneously with the development of the molten salt nuclear reactor concept. The plans and operations which were a part of the fueling of the MSRE are described. Author (NSA)

N71-21200# Los Alamos Scientific Lab., N.Mex.
HIGH-FLUX STATIONARY RESEARCH REACTORS AND THEIR OUTLOOK
S. M. Feinberg 1968 10 p refs Transl. into ENGLISH from Russian report IAE-1693 Sponsored by AEC
(LA-4399-TR) Avail: NTIS

Successful operation of stationary research intermediate-neutron reactors with a thermal neutron trap is described. The prospects of further enlargement of the neutron flux are discussed. A comparison is made with the design of a fast neutron accelerator used as the source of an intensive field of thermal neutrons. Author (NSA)

N71-21248# Gulf General Atomic, San Diego, Calif.
SPECIAL DEVELOPMENT PROBLEMS OF HIGH TEMPERATURE GAS COOLED REACTOR SYSTEMS
A. J. Goodjohn and D. B. Trauger 21 Aug. 1970 42 p refs Presented at the Conf. on Power Reactor Sys. and Components, Williamsburg, Va., 1–3 Sep. 1970
(Contracts AT(04-3)-167; AT(04-3)-314; AT(04-3)-633; W-7405-ENG-26)
(GA-10265; CONF-700904-1) Avail: NTIS

The major development areas of the HTGR system are described. Topics discussed include: fuel; prestressed concrete reactor vessel; helium circulator; steam generator; steam generator materials; and refueling equipment. Author (NSA)

N71-21249# Oak Ridge National Lab., Tenn.
ORNL NUCLEAR SAFETY RESEARCH AND DEVELOPMENT PROGRAM Bimonthly Report, Sep.–Oct. 1970
William B. Cottrell Jan. 1971 142 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-3212) Avail: NTIS

Much of this work is in general support of water-cooled power reactor technology, including LOFT and industry programs, and reflects current safety problems, such as measurements of prompt fuel element failure phenomena and the efficacy of containment-spray and filter systems for the removal of accident-released fission products and aerosols from gas streams. Several projects are also conducted in support of the high-temperature gas-cooled reactor and liquid-metal fast breeder reactor programs. Other major projects include studies of primary piping, steel pressure-vessel technology, and seismic design consideration. Experimental work relative to pressure-vessel technology includes investigations of the attachment of nozzles to shells and the implementation of joint AEC–PVRC programs on heavy-section steel technology and nuclear piping, pumps, and valves. Author (NSA)

N71-21250# Oak Ridge National Lab., Tenn.
FLUID DYNAMIC STUDIES OF THE MOLTEN SALT REACTOR EXPERIMENT (MSRE) CORE
R. J. Kedl 19 Nov. 1970 36 p refs
(ORNL-TM-3229) Avail: NTIS

In the MSRE reactor vessel, fluid fuel is circulated at 1200 gpm down through an annular region and up through 1140 passages in the graphite core. The core design was based on preliminary tests in a one-fifth scale model, followed by detailed measurements with water solutions in a full-scale mockup of the reactor vessel and internals. Presented are the models, the testing, and the data from which velocity, pressure drop and flow patterns are deduced. Also described is how the measurements were extrapolated to molten salt at 1200 F in the actual reactor. The few observations possible in the reactor were consistent with the predicted behavior. Author

N71-21251# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
THE FREADM-1 CODE: A FAST REACTOR EXCURSION AND ACCIDENT DYNAMICS MODEL
D. D. Freeman, E. G. Leff, D. J. Bender, and W. G. Meinhardt Sep. 1970 236 p refs
(Contract AT(04-3)-189)
(GEAP-13608) Avail: NTIS

FREADM-1 is a fast reactor multichannel accident analysis program designed to efficiently simulate a reactor transient from initiation to the point of core disassembly. Models are included for nuclear kinetics (point model), core thermohydraulics, voiding, fuel redistribution, failure propagation, programmed reactivity insertion, and the dynamics of primary system coolant flow. A broad range of assumed accident initiating and propagating activities may be simulated using triggering logic included in the code. FREADM-1 is restricted to accidents which initiate and propagate uniformly within annular or cylindrical coaxial core regions. Author (NSA)

N71-21252# New Jersey State Dept. of Health, Trenton.
HEAT DISCHARGES FROM NUCLEAR REACTORS
Charles G. Amato [1969] 10 p refs Presented at the Conf. on the Intern. and Interstate Regulation of Water Pollution, New York, 12 Mar. 1970
(CONF-700335-1) Avail: NTIS

The performance characteristics of coal fired and nuclear power plants in terms of heat energy releases to the environment are examined. Various approaches to waste heat management, including cooling ponds, cooling towers, and surface water discharge, are discussed. NSA

N71-21346*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACECRAFT POWER
In its Space Programs Sum. No. 37-66, Vol. 3, Oct.–Nov. 1970 31 Dec. 1970 p 70–75 (See N71-21338 10-30)
Copyright. Avail: NTIS CSCL 18L

A review of current radioisotope thermoelectric generator programs established that the SiGe Air-Vac converter has the strongest position of all thermoelectric technologies for long-term planetary missions based on the following: (1) long-term test time with relative confidence in mission performance predictions; (2) stability of SiGe material and predictability of long-term aging effects; (3) acceptance of available heat source technology for particular missions; (4) high specific power; (5) flexibility of final design adjustments in the converter; and (6) use of nonsealed converter or, if a sealed unit is used, a converter that does not require a seal after launch. Author

N71-21369 California Univ., Berkeley.
EXPLOSIVE DISASSEMBLY OF FAST SPECTRUM NUCLEAR REACTORS
John Chaeseung Lee (Ph.D. Thesis) 1969 213 p
Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00 Order No. 70-6150

Theoretical analysis of the explosive disassembly of fast spectrum nuclear reactors, following accidental loss of coolant and melting and gravity compaction of the fuel material, was undertaken. The increase in the energy released in a disassembly transient due to zoned fuel loading is shown to be 35 percent for a large fast breeder reactor. The effect on the energy release of the assumption of fixed fuel density in the equation of state is insignificant. Energy release in cylindrical geometry was calculated taking the effects due to zonal interfaces into consideration. The effect of the assumption of fixed fuel density in the equation of state, neglecting pressure wave propagation, was studied in spherical geometry. An extension of the Bethe-Tait analytical model to zoned spherical and homogeneous cylindrical cores is made, from which a scheme for obtaining a spherical core equivalent to a cylindrical core is suggested. An analytical estimate of the envelope for the oscillations in transients energy release with large Doppler feedback is obtained. Dissert. Abstr.

N71-21370# Idaho Nuclear Corp., Idaho Falls.
ULTRASONIC LIQUID LEVEL DETECTOR USING SHEAR WAVE ATTENUATION IN A BAR
A. E. Arave Nov. 1970 14 p refs
(Contract AT(10-1)-1230)
(IN-1442) Avail: NTIS

An ultrasonic liquid level detector is being designed for the 200 F to 1000 F, 2500 psi water environment of the loss of fluid test. Attenuation of an ultrasonic shear wave as it propagates in a steel bar is a function of the water covering the bar. The bar takes on different dimensions depending on the application. Magnetostrictive transducers are used to transmit and receive the 200 kHz shear waves. Author (NSA)

N71-21371# Argonne National Lab., Ill.
STUDY OF THE RESPONSE OF THE EBR-2 PLANT PROTECTIVE SYSTEM TO HYPOTHETICAL MALFUNCTIONS IN THE REACTOR SYSTEM
A. V. Campise Jun. 1970 91 p refs
(Contract W-31-109-ENG-38)
(ANL-7865) Avail: NTIS

The prompt response of the EBR-2 plant protective system to hypothetical malfunctions of reactor components has been investigated by means of a comprehensive dynamic simulation and analysis. The AIROS-2A dynamic-simulation digital code was used to model the principal neutronic, thermal, and hydraulic characteristics of typical driver-fuel and experimental-oxide-fuel elements. Response times of the EBR-2 protective system were taken from in situ measurements made at the reactor plant on circuits sensing neutron flux, coolant flow rates, and temperatures. The studies indicate that the present EBR-2 plant protective system provides responsive and redundant protection for all hypothetical malfunctions of components. Author (NSA)

N71-21579# Lockheed Missiles and Space Co., Palo Alto, Calif.
ATOM IN SPACE AND ON EARTH. LUNOKHOD FURNACE
Iu. Berestov [1970] 2 p Transl. into ENGLISH from Izv. (Moscow), no. 29(16647), 4 Feb. 1971
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A news article is presented on the potentials of using nuclear reactors in space vehicles. The primary areas of usefulness are identified as nuclear rocket engines, electrical power sources, and heat sources. Examples are given of each, including the Zond and Iantar space vehicles and the Lunokhod 1 which uses its radio isotope power plant as a heat source during the lunar night. N.E.N.

N71-21712# Argonne National Lab., Ill.
REPORT OF MEETING ON METHODS AND MODELS USED TO DESIGN FUEL PINS AND PREDICT IN-PILE PERFORMANCE
L. R. Kelman and F. A. Rough 10 Nov. 1970 56 p Conf. held at Washington, D.C., 8 9 Apr. 1970 Sponsored by AEC
(TID-25590) Avail: NTIS

Computer programs used to predict the performance of fuel elements are reviewed. Comparisons of calculational models with experimental programs are made to establish performance characteristics of fast breeder reactor fuel elements. NSA

N71-21748# Oak Ridge National Lab., Tenn.
INDEXED BIBLIOGRAPHY OF THERMAL EFFECTS LITERATURE. 1
J. G. Morgan and J. K. Franzreb Dec. 1970 163 p refs
(Contract W-7405-eng-26)
(ORNL-NSIC-81) Avail: NTIS

References concerning thermal effluents are cataloged under the following categories: general safety criteria; siting of nuclear facilities; transportation and handling of radioactive materials; aerospace safety; heat transfer and thermal transients; reactor transients, kinetics, and stability; fission product release, transport, and removal; sources of energy release under accident conditions; nuclear instrumentation, control, and safety systems; electrical power systems; containment of nuclear facilities; plant safety features (reactor); plant safety features (nonreactor); radionuclide release and movement in the environment; environmental surveys, monitoring, and radiation dose measurements; meteorological considerations; operational safety and experience; safety analysis and design reports; radiation dose to man from radioactivity release to environment; effects of thermal modifications on ecological systems; and effects of radionuclides and ionizing radiation on ecological systems. NSA

N71-21795# Battelle Memorial Inst., Columbus, Ohio.
INVESTIGATION OF THE INITIATION AND EXTENT OF DUCTILE PIPE RUPTURE, PHASE 2 Progress Report, Jul. -Sep. 1970
Robert J. Eiber, William H. Maxey, and Arthur R. Duffy Oct. 1970 8 p refs
(Contract W-7405-eng-92)
(BMI-1892) Avail: NTIS

An experiment was designed to permit measurement of the rate of rupture area development. The published data on the fracture behavior of flawed tees and elbows were reviewed. NSA

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N71-20662# Southampton Univ. (England). Inst. of Sound and Vibration Research.
FORMULAE FOR THE NON-RESONANT TRANSMISSION OF DIFFUSE SOUND THROUGH STIFF WALLS
Edmond Szechenyi Nov. 1970 24 p refs Sponsored by Sci. Res. Council
(ISVR-TR-39) Avail: NTIS

Simple formulae for the sound transmission through infinite walls are presented. The approximation of field incidence for the extension of the solution to finite plates is discussed and used. Formulae are found for all frequencies except the critical coincident frequency. The methods used are part analytical and part graphical and empirical. Author (ESRO)

N71-20713# Southampton Univ. (England). Inst. of Sound and Vibration Research.
SOUND RADIATION AND TRANSMISSION INTO UNSTIFFENED CYLINDERS
Edmond Szechenyi Oct. 1970 50 p refs Sponsored by Sci. Res. Council
(ISVR-TR-38) Avail: NTIS

Resonant and nonresonant sound transmission into cylinders is analysed in detail. For the resonant condition a statistical averaging method is used for which modal densities and average radiation efficiencies are accurately determined by graphical means and presented in chart form in terms of all the variables. With the aid of these charts, the final solutions are simple and require a minimum of computation for numerical results. Calculated sound transmission for a particular cylinder is compared to experiment with a fair degree of success. Author (ESRO)

N71-20714# Rome Univ. (Italy). School of Aerospace Engineering.
METHOD FOR MEASURING MAGNETIC DIPOLE MOMENTS [METODO PER LA MISURA DEL MOMENTO DI DIPOLO MAGNETICO]
Giorgio Ravelli May 1970 42 p refs In ITALIAN; ENGLISH summary *Its* ATTI del Centro Ric. Aerospaziali No. 27
Avail: NTIS

A method for the determination of the magnetic dipole moment by means of magnetic field intensity measurements is presented. The proposed method allows the measurement of dipole moments of small magnitude even on bodies of large dimensions and weight. Expressions are given for computing the components of the dipole moment and the corresponding radius, using a minimum number of magnetic field measurements. The characteristics of the measuring system, based on the given expressions, together with its behavior in presence of noise are then described. The results obtained with an experimental set-up of the system are also presented. Author (ESRO)

N71-20732*# TRW Systems Group, Redondo Beach, Calif.
INVESTIGATION OF INTEGRATING SPHERE MEASUREMENT PARAMETERS
B. E. Newman and G. L. Brown 31 Dec. 1970 139 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952304)
(NASA-CR-117402) Avail: NTIS CSCL 20F

The directional and bidirectional reflectance properties of MgO sphere wall coatings (smoke and pressed powder) were measured as a function of age and angle and polarization of incident radiation at wavelengths between 400 and 2500 nm. The directional reflectance increased slightly with angle of incidence. For large angles of incidence, the bidirectional reflectance was very non-diffuse both in and out of the plane of incidence. Degradation of the reflectance with age is almost entirely due to atmospheric moisture and progresses slowly after the first two weeks. Pressed MgO powder, in comparison to smoked MgO, is easier to prepare, more uniform optically, and more durable. Thick coatings of the smoked surface, however, have higher reflectance, degrade less with age, are more depolarizing and more diffuse. For maximum measurement accuracy, a thick smoked MgO wall coating is superior. The directional characteristics of a photomultiplier tube were also measured for incident energy of two polarizations and for three tube envelope conditions. Author

N71-20734*# National Bureau of Standards, Boulder, Colo.
THERMODYNAMIC AND TRANSPORT PROPERTIES OF FLUIDS AND SELECTED SOLIDS FOR CRYOGENIC APPLICATIONS Summary Report, 1 Dec. 1965–1 Nov. 1970
Victor J. Johnson and Dwain E. Diller 31 Oct. 1970 81 p refs
(NASA Order R-06-008-046; NASA Order W-12745)
(NASA-CR-117407; NBS-9782) Avail: NTIS CSCL 20L

The activities and accomplishments for the data evaluation and compilation program are summarized in the description of the following tasks: (1) properties of hydrogen and related studies including curve fitting techniques and survey of temperature scales, (2) thermodynamic properties of oxygen, (3) thermodynamic properties of argon, (4) correlation of the thermodynamic properties of deuterium, (5) transport phenomena in cryogenic fluids, (6) correlation of the thermodynamic properties of helium, (7) annotated bibliography on the properties of methane, (8) electrical resistivity of metals, (9) annotated bibliography on the properties of air, and (10) thermal conductivity of metals, alloys, and non-metallic solids. Author

N71-20824# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
ACOUSTIC ENVIRONMENTS PRODUCED BY THE C-5A AIRCRAFT DURING GROUND OPERATIONS Final Report, Sep. 1969–Apr. 1970
John N. Cole and Robert G. Powell Oct. 1970 113 p refs
(AD-716814; AMRL-TR-70-53) Avail: NTIS CSCL 20/1

Sound pressure levels produced by the C-5A aircraft during ground runup at idle, taxi, and takeoff power settings were measured at locations 200 meters radially distant from the aircraft. These data were used to compute power spectra, directivity indices, and contours of equal sound pressure level, A-weighted overall sound level, permissible exposure time, speech interference level and perceived noise level (tone-corrected). These contours can be used to estimate these quantities over a maximum range from 125 to 1500 meters from the aircraft during ground operation for standard meteorological conditions. Measurements were also made at more than 40 locations where maintenance and ground crews must typically be located during normal operations. A-weighted and C-weighted overall sound levels and permissible exposure times were determined for personnel at these locations with and without ear protection. Preferred speech interference levels were also determined. Author (GRA)

N71-20825# Arizona Univ., Tucson. Dept. of Physics.
ACCURATE PAIRING TREATMENT OF THE COULOMB INTERACTION IN THE ANDERSON MODEL OF A LOCALIZED MOMENT IN A METAL
R. H. Parmenter Dec. 1970 30 p refs
(Contract N00014-67-A-0209-0007)
(AD-716750; TR-6) Avail: NTIS CSCL 20/12

The treatment of the Anderson model of a localized moment in a metal has been extended beyond the effective-field approximation by a method recently developed for studying the Hubbard model. This leads to an accurate treatment of the Coulomb interaction associated with the localized center. The results are a simple generalization of those obtained by Anderson within the context of the effective-field approximation. Author (GRA)

N71-20917# Brookhaven National Lab., Upton, N.Y.
RIBBON EFFECT IN A SUPERCONDUCTING SEPTUM MAGNET
G. Parzen and K. Jellett 18 Nov. 1970 4 p refs
(BNL-15368) Avail: NTIS

The septum of a superconducting septum magnet is wound out of a thin superconducting ribbon. Only a small fraction of the ribbon and of the septum carries current. The effect of the number of ribbon layers on the leakage field is studied for particular application to the septum magnet for the AGS slow extraction system. Author (NSA)

N71-20937# Compagnie Francaise Thomson-Houston, Cagnes-sur-Mer, France. Div. Activites Sous-Marines.
THEORY AND PERFORMANCES OF ACOUSTICAL DISPERSIVE SURFACE WAVE DELAY LINES
C. Lardat, C. Maerefeld, and P. Tournois 18 Mar. 1970 64 p

refs Sponsored by Direc. des Rech. et Moyens d'Essais
(D.ASM-85.669-CL/CM/PT) Avail: NTIS

Properties of Love and Rayleigh waves in stratified isotropic media are compared. The study on propagation of such waves in anisotropic and piezoelectric media, carried out in view of obtaining pure modes show that two modes can be pure and only one of them at a time can be piezoelectrically stiffened. The Rayleigh wave can be stiffened if the sagittal plane is a plane of crystal symmetry, whereas the Love wave can be stiffened if the perpendicular to the sagittal plane is a binary axis. The problems in devicing dispersive delay lines using these waves are discussed and pairs of materials are given, together with the different excitation methods and expected performances of these delay lines, relating to large bandwidths and high compression ratios. The results of experiments carried out with Love and Rayleigh waves excited by ceramics directly soldered on the layer show that total untuned insertion losses can be inferior to 20 dB, with a 2.5 MHz bandwidth and inferior to 50 dB, with a 100 MHz bandwidth. The performances of a delay line whose time delay variation is nearly 8 microseconds with a 30 MHz bandwidth, the central frequency being 32.5 MHz, are also described. Author (ESRO)

N71-21085# Serendipity Associates, Arlington, Va.
A STUDY OF THE MAGNITUDE OF TRANSPORTATION NOISE GENERATION AND POTENTIAL ABATEMENT. VOLUME 2: MEASUREMENT CRITERION Final Report
Nov. 1970 117 p refs
(Contract DOT-OS-A9-018)
(OST-ONA-71-1-Vol-2) Avail: NTIS

A-weighted sound level (in dbA) and noise pollution level (in dbA) were examined to determine their relationships to other measures and their prediction of reaction; i.e., loudness, annoyance, noisiness. The A-weighted sound level, on the average, correlated as well with subjective response as the other measures. Only for jet aircraft pure tones was there a significant predictive performance difference between effective perceived noise level and dbA. Average community response measures were developed for aircraft and motor vehicle noise. Using the aircraft noise and number index and motor vehicle traffic noise index data, the noise pollution level was shown to correlate as well with average community response as both of the measures. Author

N71-21142# Ecole Nationale Superieure de Mecanique, Nantes (France).
TIME CONSTANT EFFECT IN THE RECORDING OF A DIFFRACTION LINE [EFFET DE LA CONSTANTE DE TEMPS DANS L'ENREGISTREMENT D'UNE RAIE DE DIFFRACTION]
R. Cheron *In its* Ann. of Mech. Semiann. Rept., 1969 p 231–233 refs In FRENCH (See N71-21133 10-32)
Avail: NTIS

Two methods exist for recording the intensity of a diffraction line with a counter, namely the intensity variation continuous recording and the step by step recording. The results obtained by these two methods are compared. ESRO

N71-21372# Office of Naval Research, London (England).
MODEL STUDIES IN ACOUSTICS
Richard O. Rowlands 7 Dec. 1970 10 p refs Presented at Brit. Acoust. Soc. Conf., London, 12 Nov. 1970
(AD-716950; ONRL-C-31-70) Avail: NTIS CSCL 20/1

A report is given on a one-day conference at which six papers were presented. The areas covered represented models in room acoustic, models in sound insulation measurement and a model for estimating traffic noise near roadways. Author (GRA)

N71-21373# Ballistic Research Labs., Aberdeen Proving Ground, Md.
CURRENT DIFFUSION IN CYLINDRICAL WIRES AND FUSES DURING MICROSECOND ELECTRICAL PULSES
F. D. Bennett Nov. 1970 23 p refs
(AD-717003; BRL-1512) Avail: NTIS CSCL 19/1

Existing solutions to the diffusion equation for current in a cylindrical conductor are used to provide estimates of the non-uniformity of current density during typical wire explosions. These estimates are given in the form of inequalities which are then used to specify the conditions under which current distribution and heating effect can be considered uniform. Author (GRA)

N71-21376# Istituto di Fisica dell Atmosfera, Rome (Italy).
MIE EXTINCTION COEFFICIENT FOR SPHERICAL PARTICLES m = 1.33, ALPHA = 0.1(0.1)200; m = 1.55, ALPHA = 0.1(0.1)30
G. Tonna Jun. 1970 25 p refs
(IFA-SR-30) Avail: NTIS

The real refractive indices, size parameter range, and increments for m = 1.33, alpha = 0.1 (0.1) 200; m = 1.55, alpha = 0.1 (0.1) 30, have been calculated. Author (ESRO)

N71-21408*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ACOUSTIC SCATTERING BY A POROUS ELLIPTIC CYLINDER WITH NONLINEAR RESISTANCE
William Edward Zorumski (Ph.D. Thesis—Virginia Polytech. Inst.) Mar. 1971 109 p refs
(NASA-TM-X-67019) Avail: NTIS CSCL 20A

Equations for high intensity acoustic waves are derived from the general equations governing a compressible isotropic Newtonian fluid. The integral conservation laws of continuum mechanics are used to determine a general set of laws, similar to shock wave relations, which describe the interaction of these waves with thin porous sheets of material. A special case of these laws, where the velocity normal to the sheet is continuous and the pressure drop across the sheet is a nonlinear function of the normal velocity, is used to study acoustics problems with nonlinear material effects. Numerical, approximate, and exact solutions are obtained from the one-dimensional problem where two regions are coupled through a porous sheet with nonlinear resistance. Solutions for scattering from a thin rigid porous elliptic cylindrical shell are found in terms of Mathieu functions. Coupling terms in these equations are given by integrals involving Mathieu functions which are evaluated by exact methods. Author

N71-21442# Royal Aircraft Establishment, Farnborough (England).
THE INFLUENCE OF MICROSCOPIC OBJECTIVES ON THE MEASUREMENT OF THE MODULATION TRANSFER FUNCTION OF OPTICAL SYSTEMS [UEBER DEN EINFLUSS VON MIKROOBJEKTIVEN BEI DER MESSUNG DER MODULATIONS-UEBERTRAGUNGSFUNKTION OPTISCHER SYSTEME]
P. Kuttner Oct. 1970 14 p ref Transl. into ENGLISH from Opt. Acta (Paris), v. 16, no. 6, 1969 p 761–770
(RAE-Lib-Trans-1522) Avail: NTIS

Measurement of the optical transfer function (OTF) often involves the use of a microscopic objective for enlarging the intensity distribution on the image side. In order to study the influence of microscope objectives on the accuracy of the OFT, measurements were made on a well corrected high speed lens with and without the use of a microscopic objective. An instrument which does not employ such an objective was modified so that the OTF could be measured first with, and then without, a microscope objective on the image side. Only microscope objectives believed to be very well corrected within the range of apertures used had no influence on the results. Microscope objectives which were only well corrected on axis gave rise to considerable errors of measurement when off-axis measurements were made. Author

N71-21491*# Boeing Co., Seattle, Wash. Aerospace Operations.
CYROGENIC POSITIVE EXPULSION DIAPHRAGMS Final

Report, Oct. 1967 - Jun. 1970
C. L. Lofgren and D. E. Gieseking Oct. 1970 79 p refs
(Contract NAS3-11204)
(NASA-CR-72732) Avail: NTIS CSCL 20L

The design fabrication and test of twenty polymeric film expulsion diaphragms for liquid hydrogen are described. The diaphragms, of single ply vapor barrier construction, failed during the liquid hydrogen test cycling. A failure analysis is included. Author

N71-21504# Naval Ordnance Station, Indian Head, Md.
ON SOME PHYSICAL PROPERTIES OF FLAMES. PART 1: GENERAL THEORY
Alfonso Compolattaro and Ottmar H. Dengel 30 Sep. 1970 23 p refs
(AD-716968; NOS-IHTR-326-Pt-1) Avail: NTIS CSCL 21/2

The general results of the approach which regards a flame as a partially ionized gas which is stable in a space region where this plasma is confined are described. The boundary of this region defines the flame profile. A system of linear differential equations has been deduced, and its solutions which satisfy the prescribed stability conditions have been determined and analyzed. The approach, characterized by a marked handiness of the mathematical algorithm, seems promising for studying the propagation of electromagnetic waves in flame gases and for testing the time-dependency in combustion processes. Author (GRA)

N71-21514*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THERMAL ACTIVE OPTICS TECHNIQUE FOR CORRECTING SYMMETRICAL DISTORTIONS IN SPACE TELESCOPE MIRRORS
Marvin D. Rhodes (M.S. Thesis Virginia Univ.) Sep. 1970 79 p refs
(NASA-TM-X-67020) Avail: NTIS CSCL 20F

Orbiting astronomical observations have the potential for making observations far superior to those from earth-based mirrors. In order for this performance to be realized, the contour of the primary mirror must be very accurately controlled. A thermally activated system for correcting symmetrical distortions in space telescope mirrors was evaluated. This system utilizes thermally induced elastic strains to correct axial distortions in the mirror. The relation between axial distortion and thermal inputs was determined by a finite difference solution of the equations for thin elastic shells. The use of this technique was demonstrated analytically on a beryllium paraboloid. This mirror has 10 equally spaced thermal inputs. Distortions due to an acceleration-type loading were shown to be corrected to well within the required accuracy. Axial temperature gradients resulting from the application of the thermal inputs to the rear surface of the mirror were shown to be quite small. Author

N71-21534# Tata Inst. of Fundamental Research, Bombay (India.)
LECTURES ON THEORY OF MAGNETISM
R. J. Elliott 1970 114 p refs
Avail: NTIS

The lectures on solid state physics delivered at Bangalore in 1969 are presented. Topics include: magnetic properties of noninteracting ions, ligand field effects, exchange interactions, and order-disorder of coupled magnetic systems. F.O.S.

N71-21555*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
SONIC RADIATION FROM A CIRCULAR PISTON WITH IMPULSE EXCITATION
Leon Bess Washington Mar. 1971 19 p refs
(NASA-TN-D-6270; C-140) Avail: NTIS CSCL 20A

The sonic pressure as a function of space and time has been calculated in closed analytic form for a circular piston whose displacement is a step function in time. The method of calculation involves approximating the piston by a uniform array of very small spherical sources. Author

N71-21574*# TRW Systems Group, Redondo Beach, Calif. Engineering Mechanics Section.
USER'S MANUAL FOR THE GNAT COMPUTER PROGRAM: NUMERICAL ANALYSIS OF STRATIFICATION IN SUPERCRITICAL OXYGEN
P. J. Heinmiller Mar. 1971 30 p refs
(Contract NAS9-9-8166)
(NASA-CR-114963; TRW-17618-J121-R0-00) Avail: NTIS CSCL 20L

The General Numerical Analysis of Transport (GNAT) computer program which is a detailed stratification model of the Apollo supercritical oxygen storage tank is discussed. Numerical methods are used in the program to solve the conservation equations which govern the behavior of a compressible fluid under low accelerations. The program computes the pressure, temperature, density, and velocity components at points distributed throughout the fluid in the tank. Real fluid properties permit the calculation of potential pressure collapse due to the sudden mixing of a thermally stratified fluid. Although the program normally requires a significant amount of computer time to execute, scaling of pertinent parameters may be used to reduce this required time. In addition, program re-start capability is also provided by storage of output data on magnetic tape. Author

N71-21597 Northwestern Univ., Evanston, Ill.
SIZE-DEPENDENT OSCILLATORY MAGNETORESISTANCE IN CADMIUM
Paul David Hambourger (Ph.D. Thesis) 1969 156 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 70-6470

A detailed investigation of the size effect oscillations in cadmium was made using the field modulation technique. Twelve sets of oscillations were observed, of which nine were detected for the first time. The remaining three periods were observed with greater resolution over wider ranges of field orientation than in previous experiments. Ten sets of oscillations showed the growth in amplitude with magnetic field predicted for the extremal oscillations although in some cases the initial amplitude growth was followed by rapid damping of the oscillations at higher fields. The data are compared with the pseudopotential Fermi surface model of Stark and Falicov, and the oscillations are assigned to orbits on the 2nd-band monster and 3rd-band lens sheets of the surface. The results confirm the prediction that the new oscillations arise from orbits having extremal values. Dissert. Abstr.

N71-21631# Army Electronics Command, Fort Monmouth, N.J.
DIGITAL COMPUTER SOLUTION OF MAGNETIC FIELD PROBLEMS
Charles M. De Santis Nov. 1970 46 p refs
(AD-716992; ECOM-3358) Avail: NTIS CSCL 20/3

A computer program for the analysis of magnetic field problems involving ferromagnetic materials is described. A discussion of the equations describing such problems, the boundary conditions employed, and the method of modeling on a digital computer is presented. Finally, in four appendices, the difference expressions for Laplaces equation and the non-linear magnetic equation are derived, the boundary approximations used in the computer program are presented and explained, and the general make-up and use of the program in its time sharing format is described. Author (GRA)

N71-21634# Ohio State Univ. Research Foundation, Columbus.
SUPERSONIC COMBUSTION AND BURNING IN RAMJET COMBUSTORS Final Report, 1 Feb. 1966 - 31 Mar. 1970

Rudolph Edse Jun. 1970 205 p refs
(Grant AF-AFOSR-0203-67)
(AD-716855; OSURF-2153-3; AFOSR-70-2467TR) Avail: NTIS CSCL 21/2

Induction distances, transient pressures, and wave propagation rates were determined in cylindrical tubes for detonation waves in stoichiometric hydrogen-oxygen mixtures initially at one atmosphere and temperatures ranging from 300K down to 123K. The induction distances became considerably shorter as the initial gas temperature was decreased. At temperatures from 500 to 123K the normal burning speed of stoichiometric hydrogen-oxygen mixtures was found to be proportional to the absolute temperature of the unburnt gas. High-strength shock waves were fired into lean hydrogen-oxygen mixtures to study the propagation rates of the flames behind these waves (overdriven detonations). Ignition delay times in hydrogen-nitric oxide mixtures were found to be very long. Stable detonation waves could not be produced in these mixtures. Quantum yields and induction times have been measured in flowing mixtures of hydrogen, oxygen, and chlorine to determine the feasibility of photochemically initiated supersonic combustion. Expressions have been derived to predict the induction times and quantum yields. A method has been developed for calculating the state of the gas behind a normal shock in a shock tube for the case that both the driver and the driven gas undergo chemical changes during the process. Resulst indicate that for dissociating hydrogen calculations based on the use of certain values of the specific heat ratio may be in error by 30% for the calculated particle speed. Author (GRA)

N71-21638# California Univ., Berkeley.
TRANSPORTATION SYSTEM NOISE GENERATION, PROPAGATION, AND ALLEVIATION. PHASE 1, PART 1
Robert Horonjeff and Walter W. Soroka Sep. 1970 181 p refs
(Contract DOT-OS-A9-118)
(PB-196391; DOT-OST-ONA-71-2-1-Pt-1) Avail: NTIS CSCL 20A

Contents: Progress report in research on noise annoyance; A preliminary study of sound propagation around obstacles; An analysis of noise levels generated by jet transport aircraft; On measuring the cost of noise from subsonic aircraft; Progress report on land use, community impact, and land value project. GRA

N71-21755# Lockheed Missiles and Space Co., Palo Alto, Calif.
SCATTERING BY WEAK VOLUME INHOMOGENEITIES (BORN APPROXIMATION)
S. M. Rytov [1970] 10 p Transl. into ENGLISH from the book 'Vvedenie v Statisticheskuiu Radiofiziku' Moscow, Nauka, 1966 p 369–379
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Wave propagation in a medium with volume inhomogeneities is investigated. Volume scattering is described by differential equations with coefficients varying in time and space. Exact solutions to the problems were not found. Approximate solutions are given for all problems. E.H.W.

N71-21757 California Univ., Berkeley.
TRANSVERSE MODE LOCKING
David Henry Auston (Ph.D. Thesis) 1969 154 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 70-6054

The results of an experiment are presented in which it is demonstrated that a spatially scanning optical beam can be produced by phase locking transverse modes. A special helium-neon laser was required for the experiments. Mode locking was attained with the use of an internal modulator. An antisymmetric acoustic oscillation was established in the crystal which had the effect of introducing a time varying misalignment to the optical resonator. The interaction of the optical field with the modulator and the laser medium was analyzed by transforming Maxwell's wave equation into an operator equation in which the electric field is represented by a vector in a Hilbert space, and its interaction with the modulator and the active medium is accounted for by a susceptibility operator. The electric field was then represented by a distribution of classical coherent states, and the susceptibility was expressed in terms of annihilation and creation operators. Results are given for linear and nonlinear models of the active medium. Dissert. Abstr.

N71-21762 California Univ., Riverside.
MAGNETIC PROPERTIES AND HYPERFINE FIELD IN FERROMAGNETIC IRON
Kenneth John Duff (Ph.D. Thesis) 1969 151 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 70-6349

The nature of the conduction electron states in ferromagnetic iron is described by a theoretical treatment of the magnetic properties. The principle basis of this work is a new band structure for the metal calculated by a variational method. In addition, the hyperfine field due to core electrons is found by a perturbation process, and in course of this evaluation, Hartree-Fock perturbation theory has been reformulated. The band structure calculation differed from previously used methods in a number of important respects. Incorporated in the trial wave function for every state were both orthogonalized plane waves and localized d character described by tight-binding wave functions. A detailed treatment of exchange effects was attempted without using local approximations. Dissert. Abstr.

N71-21778# North Carolina State Univ., Raleigh.
ACOUSTIC EMISSIONS FROM BOILING BUBBLES Progress Report, Feb. – Nov. 1970
R. F. Saxe Dec. 1970 32 p refs
(Contract AT(40-1)-3911)
(ORO-3911-3) Avail: NTIS

Activities are reported on programs to obtain information on parameters associated with generation of acoustic energy by boiling bubbles and to a further understanding of boiling bubble dynamics. Results of investigations on bubble sound emission, and bubble acoustic characteristics are included. NSA

N71-21798# California Univ., Berkeley.
TRANSPORTATION SYSTEM NOISE GENERATION, PROPAGATION AND ALLEVIATION. PHASE 1: PART 2: BIBLIOGRAPHY
Robert Horonjeff and Walter W. Soroka Sep. 1970 217 p refs
(Contract DOT-OS-A9-118)
(PB-196392; DOT-OST-ONA-71-2-Pt-2) Avail: NTIS CSCL 20A

A bibliography of research on noise annoyance was collected and presented in sections with summaries of research in each section and annotations for many articles. Special emphasis was placed on a review of existing and possible methodologies in research and on the collection of relevant articles from diverse disciplines. Sections are included on loudness and noisiness, psychological responses, survey research, physiological responses, effects on performance, single attribute scaling, multiattribute scaling, community noise, noise propagation, general discussions of the problem of noise, and bibliographies. Author (GRA)

N71-21800# California Univ., Berkeley. Lawrence Radiation Lab.
NONLINEAR OPTICAL EFFECTS
Y. R. Shen Oct. 1970 30 p refs Presented at the Conf. of the Phys. of Opto-Electron. Mater., Gen. Motors Res. Symp., Warren, Mich.
(Contract W-7405-eng-48)
(UCRL-20358; CONF-701026-1) Avail: NTIS

Third-harmonic generation in cholesteric liquid crystals, far-infrared generation by ultrashort pulses, and self-focusing of light in nonlinear media are taken as examples for illustration of nonlinear optical effects. Depending on the problems, different approximations are used in solving the nonlinear wave equations. Connections between nonlinear optical effects and properties of the media are briefly discussed. Author

N71-21821* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LIGHT POSITION LOCATING SYSTEM Patent
John M. McLauchlan, inventor (to NASA) Issued 21 Nov. 1967 (Filed 31 Aug. 1964) 5 p Cl. 250-232 Sponsored by NASA (NASA-Case-XNP-01059; US-Patent-3,354,320; US-Patent-Appl-SN-393464) Avail: US Patent Office CSCL 20F

An apparatus is provided for producing signals which represent information indicative of the location of a light source which is permitted to be imaged upon the photo detecting surface through a mask having a rectangular shaped opening over which a shutter is oscillated with a differently shaped opening. The output of the photo detector comprises pulses whose widths represent information as to the position of the light source.
Official Gazette of the U.S. Patent Office

N71-21827 Rochester Univ., N.Y.
THE AXIAL DISPERSION OF MASS IN PACKED BEDS
Uygur Kokturk (Ph.D. Thesis) 1969 213 p
Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00 Order No. 70-2885

The axial dispersion in beds packed with spherical glass particles was investigated. The experimental technique involved inserting a pulse of dye into the column and measuring point values of the tracer concentration at five different radial positions at the inlet and outlet of the test section. An on-line computer was used for data acquisition. The data were analyzed on the basis of the dispersion model. It was concluded that the velocity profiles in packed beds are not uniform but peak near the wall and that the dispersion model describes axial dispersion quite accurately at any radial position. Dissert. Abstr.

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N71-20625# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
PREPARATION OF MICA SPECIMEN SUPPORT FILMS FOR ELECTRON MICROSCOPY AND RADIATION DAMAGE INDUCED BY HIGH ENERGY ELECTRON BOMBARDMENT
Hermann J. Spitzer Jun. 1970 14 p refs
(AD-717037; USAMERDC-1982) Avail: NTIS CSCL 20/6

A technique for the preparation of single crystalline mica specimen support films for transmission electron microscopy is presented, and the effects of electron irradiation on lattice stability, mechanical and electrical behavior, and background phase contrast are studied. Author (GRA)

N71-20627# Texas A&M Univ., College Station. Dept. of Chemistry.
REACTIONS OF HIGH ENERGY RADIOACTIVE ATOMS RESULTING FROM NUCLEAR TRANSFORMATIONS IN THE SYSTEMS OF SILICON CONTAINING COMPOUNDS Progress Report, Feb. 1970 Jan. 1971
Yi-Noo Tang 1 Nov. 1970 60 p refs
(Contract AT(40-1)-3898)
(ORO-3898-2) Avail: NTIS

Reactions of high energy chlorine atoms, formed by the nuclear reaction Cl-37(n,gamma)Cl-38, with silicon-containing compounds were studied. The reactions of tritium from the reaction He-2(n,p)H-3 with silanes were also investigated along with reactions of Si-31 from the P-31(n,p)Si-31 reaction. NSA

N71-20631# California Univ., Los Angeles. School of Engineering and Applied Science.
AN ANALYTICAL STUDY OF THE PRODUCTS OF COLLISIONS OF 1 eV ATOMS WITH CONTAMINATED SURFACES
Kuang-Chi Chiang Sep. 1969 122 p refs
(Grant NSF GK-1854)
(Rept-69-53) Avail: Issuing Activity

A simple classical model of interactions between incident gas molecules and a contaminated surface is proposed. If the energy of the beam particles is sufficiently high, say 1 to 10 eV, then absorbed particles can be dislodged during these interactions. Calculations indicate that, if the adsorption potential varies periodically along the surface, the adsorbed particles are sputtered into a multilobular distribution. The positions of the peaks depend on the velocity of the incident particles, the heat of adsorption, the amplitude of the adsorption-potential variation, and the equilibrium adatom-surface distance. For a relatively clean surface, the scattering distributions are nearly diffuse with a prominence in the forward direction. Calculation results for an argon beam impinging on mica and silver surfaces contaminated with water vapor agree qualitatively with pertinent experimental results. Hence the present model provides a possible explanation for the observed multilobular scattering distributions. Author

N71-20648# Washington Univ., Seattle. Dept. of Physics.
CLASSICAL SCHWINGER TERMS
David G. Boulware and S. Deser (Brandeis Univ.) [1970] 11 p refs Sponsored in part by US Air Force
(Contract AT(45-1)-1388)
(RLO-1388-584) Avail: NTIS

Schwinger terms must be present in equal-time ground-state Poisson brackets among currents unless the latter are stationary in that state. Author (NSA)

N71-20650# Oak Ridge National Lab., Tenn.
ACTIVITIES OF THE ANS-6 SUBCOMMITTEE ON RADIATION SHIELDING STANDARDS
H. Clyde Claiborne, Donald J. Dudziak, and Norman M. Schaeffer Dec. 1970 17 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3251) Avail: NTIS

A special report is given on the activities of the ANS-6 Subcommittee on Radiation Shielding Standards that was prepared for presentation at the special session entitled Current Status of Nuclear Standards Development at the 1970 winter meeting of the American Nuclear Society at Washington, D.C. A brief discussion of the history, organization, and philosophy of the ANS-6 Subcommittee and a report on the accomplishments and current activities of the existing working groups are presented, which include: shielding cross section standards, benchmark problems, shield performance evaluation, shield materials, and shielding nomenclature. Author (NSA)

N71-20659# Washington Univ., Seattle.
LOOP DIAGRAMS IN DUAL RESONANCE THEORIES WITH NONLINEAR TRAJECTORIES
M. Baker and D. D. Coon Sep. 1970 32 p refs Prepared in cooperation with Minnesota Univ., Minneapolis.

(Contracts AT(45-1)-1388); AT(11-1)-1764)
(RLO-1388-592) Avail: NTIS

Explicit expressions for the self-energy graph, the vacuum bubble graph, and the vertex graph are given. In the limit of linear trajectories the integrands of these graphs diverge. This is in contrast to the behavior of the tree graphs which approach the Veneziano tree graphs in the same linear limit. It is also shown that when the trajectories are nonlinear the self-energy graph including the integrand d sup 4 k is finite. The rules were developed without consideration of the factorization properties of the nonlinear n point Born term. In this sense they are analogous to the original Veneziano loop diagram rules of Kikkawa, Sakita and Virasoro, which were subsequently modified by the requirements of factorization. However, although the rules may likewise be modified, they present a simplified context for developing techniques which are of general value for the study of the nonlinear theory. Author (NSA)

N71-20680# Washington Univ., Seattle. Dept. of Physics.
DUAL RESONANCE THEORY WITH NONLINEAR TRAJECTORIES
M. Baker and D. D. Coon (Minnesota Univ.) [1970] 51 p refs
(Contracts AT(45-1)-1388; AT(11-1)-1764)
(COO-1764-90) Avail: NTIS

A dual resonance model with nonlinear trajectories which includes the Veneziano model as a limiting case is discussed. Rules are given for constructing the N-point function in such a model, and an explicit expression for the N-point planar tree graph is derived. A conjectured rule for loop diagrams is also presented. Representations of four-point function satellite terms which admit straightforward generalization to the N-point function are derived. Author (NSA)

N71-20676# Naval Research Lab., Washington, D.C.
SOLITARY WAVE PHENOMENA IN THE SOZOTRON Interim Report
David C. De Packh and Peter B. Ulrich Nov. 1970 23 p refs
(AD-716736; NRL-MR-2163) Avail: NTIS CSCL 20/7

A correlation has been made between the observed growth of longitudinal signal at late times in the NRL electron storage ring (Sozotron) and the behavior of a set of nonlinear dispersive partial differential equations describing the behavior, in one dimension, of a charge fluid in a perfectly conducting pipe. The signal is seen to be due to recurrences of solitary waves, solitons, in a low enough frequency mode to be observable by the low pass monitoring system. Author (GRA)

N71-20686# Minnesota Univ., Minneapolis. School of Physics.
MOMENTUM SPECTRA IN HIGH ENERGY HADRON DEUTERON INTERACTIONS
E. Coleman [1970] 10 p refs
(COO-1764-115) Avail: NTIS

Momentum spectra were measured for the scattering of protons by deuterons at 2.784 GeV/c and for the scattering of negative pions by deuterons at 5.53 GeV/c. The measurements test multiple scattering theories. The roles of double scattering processes, interference phenomena, nucleon-nucleon correlations, and production processes were examined. NSA

N71-20690# Los Alamos Scientific Lab., N.Mex.
NUMERICAL EXPERIMENTS WITH A NONLINEAR CHAIN
F. M. Izrailev et al 1968 21 p refs Transl. into ENGLISH from Russian Preprint no. 252
(LA-4440-TR) Avail: NTIS

Results of numerical experiments with a chain of nonlinear coupled oscillators are presented. The experiment was to check the existence and position of the stochasticity border. Several methods to detect stochasticity were used, including energy spectrum, various correlations, and local instability. The results are in reasonable agreement with analytical estimates. They also demonstrate a very complex structure of the intermediate zone separating the region of stochasticity from that of Kolmogorov's stability. In particular the local instability begins at a considerably smaller beta-value then one at which time correlations vanish. Even under the strongest excitation, the lowest modes were not completely stochastic. The fluctuations of the system's full energy, due to computational errors, were relatively large (up to 3%). Author

N71-20696# Mound Lab., Miamisburg, Ohio.
A PEAK STRIPPING PROGRAM FOR THE NUCLEAR DATA 50/50 ANALYZER SYSTEM
F. X. Haas 21 Dec. 1970 19 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1773) Avail: NTIS

Two computer subroutines have been written for the PDP-8L computer for the purpose of analyzing spectra displayed by a nuclear data 50/50 analyzer system. The program is being used to operate on gamma-ray spectra obtained with a Ge(Li) spectrometer, but could easily be used for any spectrum accumulated in the analyzer. The peak strip routine gives the peak centroid, energy, and area for an intensified peak. The peak normalize subroutine includes the printout of the peak centroid, peak energy, the count rate in counts per second, its statistical error, the relative intensity of the peak relative to some stored intensity, and the statistical error in the relative intensity calculation. Author (NSA)

N71-20697# California Univ., Livermore. Lawrence Radiation Lab.
PREAMPLIFIER NOISE EFFECTS ON SPECTROMETER ENERGY RESOLUTION
G. A. Armantrout 23 Oct. 1970 8 p refs Presented at IEEE Nucl. Sci. Symp., New York, 4–6 Nov. 1970 Sponsored by AEC
(UCRL-72481; CONF-701109-1) Avail: NTIS

Determining the detector contribution or the total system resolution of a Ge(Li) detector by quadrature subtraction or addition of electronic noise introduces serious error due to the non-Gaussian effects of carrier trapping. The contributions of electronic noise and detector spread to the total system resolution are found by computer spectrum simulation to be greater than expected. The conclusions are substantiated by agreement with experimental measurements. Author

N71-20706# Chicago Univ., Ill.
MEASUREMENT OF THE UP DOWN ASYMMETRIES IN THE BETA DECAY OF POLARIZED LAMBDAS
J. Lindquist, R. L. Sumner, J. M. Watson, R. Winston, D. M. Wolfe et al [1970] 16 p refs Presented at the 15th Intern. Conf. on High Energy Phys., Kiev, 26 Aug.–4 Sep. 1970 Sponsored by AEC
(COO-1545-87; CONF-700806-54) Avail: NTIS

The experiment on the beta decay of the Lambda hyperon was performed in order to study the form of the weak interaction in this decay by measuring the up-down asymmetries of neutrinos, electrons, and protons with respect to the Lambda spin. Spark chambers and counters were used for this study. NSA

N71-20707# Columbia Univ., New York.
HISTORY OF WEAK INTERACTIONS
T. D. Lee Jul. 1970 16 p
(Contract AT(30-1)-1932)
(NYO-1932(2)-186) Avail: NTIS

This review of weak interactions covers the early history from the idea of the neutrino and the phenomenological Lagrangian of the beta decay interaction to the theory of the intermediate boson and the electron spectrum in muon decay. The transition period is discussed and covers the decays of strange particles to the discovery of the electronic and the muonic neutrinos. Finally

the present status of weak interactions is described listing the general properties of these interactions and important unresolved problems. NSA

N71-20720# Rome Univ. (Italy). Inst. of Physics.
SEARCH FOR EXCESS ELECTRON PHOTO-EJECTION IN LIQUID HELIUM
V Mazzacurati, F. E. Moss, and M. Sampoli 4 Jul. 1970 17 p refs *Its* Nota Interna No. 263
Avail: NTIS

An attempt was made to detect the photo-ejection cross-section of the excess electrons in liquid helium, in the wavelength region between 0.5 and 1.5 microns. A lower limit of about 2.0 x 10 to the minus 15th power sq cm was obtained, which was way out from subsequent theoretical calculations (2.0 x 10 to the minus 18th power sq cm). On the basis of the recent theory of the bubble model, a new absorption experiment, in the wavenumber region of 800 to 2500 per cm, using this nonconventional technique, is suggested. Author (ESRO)

N71-20721# Rome Univ. (Italy). Inst. of Physics.
NONLINEAR EFFECTS IN QUANTUM ELECTRODYNAMICS
V. Costantini, B. De Tollis, and G. Pistoni 12 Jun. 1970 103 p refs *Its* Nota Interna No. 273
Avail: NTIS

The fourth-rank vacuum polarization tensor, which is related to the lowest-order nonlinear interaction between four electromagnetic fields in quantum electrodynamics, is exactly calculated in terms of rational, logarithm, and dilogarithm functions when two of the four electromagnetic fields describe photons off the mass shell (in particular, photon-photon scattering). From the explicit expression of the polarization tensor the exact amplitudes for photon-photon scattering, photon splitting, and photon coalescence into photons on nuclei were obtained. The real and imaginary part of Delbrueck scattering in the form of threefold integrals over the momentum transferred to the nucleus by one of the two virtual photons is given. An explicit expression for the differential cross-section of Delbrueck scattering in the limit of low energies is also given. Author (ESRO)

N71-20722# Mound Lab., Miamisburg, Ohio.
STABLE GASEOUS ISOTOPE SEPARATION AND PURIFICATION: JULY–SEPTEMBER 1970
11 Dec. 1970 35 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1768) Avail: NTIS

Developments are reported for studies on carbon isotope separation; separation of stable isotopes of argon, krypton, neon, and xenon; and thermal diffusion research. NSA

N71-20723# California Univ., Berkeley. Lawrence Radiation Lab.
FINDING EVENTS IN A SEA OF BUBBLES
Howard S. White Oct. 1970 26 p refs Presented at the Symp. on Future Extraction and Selection in Pattern Recognition, Argonne, Ill., 5–7 Oct. 1970
(Contract W-7405-eng-48)
(UCRL-20126; Conf-701015-1) Avail: NTIS

DAPR is a digital automatic pattern recognition system, designed to find and measure events in bubble chamber film without manual intervention. It is able to measure film which has come directly from the photographic development process, and to produce on magnetic tape a digital abstraction of the information contained in the film, from which a subsequent selection of desired events takes place by means of a digital scanning process. The DAPR system achieved production status earlier this year, and already has abstracted more than fifty thousand bubble chamber picture sets. Although development continues in some areas of the programs, DAPR measurements are being used by physics experimenters in the analysis of their data. It is expected that DAPR will process an increasing fraction of the data as the measurement of current experiments is completed, and that of new experiments is begun. Author (NSA)

N71-20756# Georgia Inst. of Tech., Atlanta. School of Physics.
FORMATION OF EXCITED HYDROGEN ATOMS BY CHARGE TRANSFER AND DISSOCIATION Progress Report, 1 Dec. 1969–30 Nov. 1970
E. W. Thomas, J. L. Edwards, J. C. Ford, and R. L. Fitzwilson 30 Nov. 1970 29 p refs
(Contract AT(40-1)-2591)
(ORO-2591-51; PR-6) Avail: NTIS

Results of measurements of total cross sections for formation of fast excited hydrogen atoms by charge exchange in proton collisions with Ar, He, H2, and N2 at incident-proton energies of 75 to 350 keV are reported briefly. The results indicate that the available theoretical predictions of charge-exchange cross sections are in serious error. An investigation of formation of metastable hydrogen atoms by similar process as a function of projectile scattering angle is also described. Results for collisions of 10-keV protons with He are included as an example. More detailed reports have been or will be published. Work not yet completed and future plans are summarized. NSA

N71-20759# California Univ., Berkeley. Lawrence Radiation Lab.
STUDY OF THE SIGMA HYPERON (1915) RESONANCE IN THE REACTION KAON(−) PROTON YIELDS LAMBDA HYPERON PION (0)
R. P. Ely, Jr., R. W. Birge, J. Hoven, G. E. Kalmus, D. Kane et al Aug. 1970 16 p refs Presented at 15th Intern. Conf. on High Energy Phys., Kiev
(Contract W-7405-eng-48)
(UCRL-19789; CONF-700806-53) Avail: NTIS

The interactions negative kaon + proton yields Lambda hyperon + neutral pion were studied at the energies 1.865 to 2.001 GeV in a hydrogen bubble chamber to study the mass, width, coupling, and relative phase of the Sigma hyperon (1915) resonance. Alternative spin-parity assignments were sought but not found. The mass was found to be 1911 + 15 or −5 MeV, the width was 74 + or − 10 MeV, t = 0.01, and the phase was 179 deg + 20 or −10. NSA

N71-20760# RAND Corp., Santa Monica, Calif.
STATISTICAL MODEL CALCULATIONS OF Fe56 NEUTRON CROSS SECTION
S. D. Bloom, J. M. Green, H. W. Hubbard, and S. A. Moszkowski Sep. 1970 34 p refs Sponsored in part by AF
(AD-717216; R-591) Avail: NTIS CSCL 20/8

The present work is part of an Air Force initiated program to calculate certain neutron cross sections which have not been measured. The first paper serves the purpose of determining the free parameters in the calculational scheme while at the same time extending and improving the results for Fe56. The new element in the calculation is the use of a statistical level density formula to describe unknown high energy states of the daughter nucleus. This allows the extension of the calculation to higher neutron energies and in particular to multiple particle emissions. The success with which this new computational system provides one with a thorough and self-consistent picture of the neutron reactions on Fe56 over a large range of neutron energies, and gives one confidence that he may now proceed to estimate theoretically neutron cross-sections for other nuclei of interest. Author (GRA)

N71-20790# Pennsylvania Univ., Philadelphia. Dept. of Physics.
ON THE POSSIBILITY THAT PULSES OF A LONG RANGE FIELD ARE THE SOURCE OF CP NONINVARIANCE

K. R. Atkins and K. Lande 4 Dec. 1970 6 p refs Sponsored by AEC
(NYO-2171-329; UPR-0001T) Avail: NTIS

The possibility that pulses of a long range field are the source of CP noninvariance neutral kaon decays is explored. An experimental test involving correlation in the decay of two neutral kaon yields positive pion plus negative pion is proposed. Author (NSA)

N71-20805# Addis Translations International, Woodside, Calif.
DISCONTINUOUS PHASE OSCILLATIONS IN PARTICLE ACCELERATORS
G. Bathow et al Aug. 1969 41 p refs Transl. into ENGLISH from German report DESY-69/29 Sponsored in part by AEC Prepared for Stanford Linear Accelerator Center
(SLAC-Trans-124) Avail: NTIS

Phase oscillations in particle accelerators are comprehensively treated for the case of discontinuous acceleration. A phase oscillation parameter Z is introduced into the difference equation for the phase and energy deviations. The quantity Z covers the influence of the characteristic accelerator parameters on the phase motion; it also describes the phase amplitude damping. The results show that, for accelerators having a constant Z of the order of unity, resonances will occur which critically influence the phase stability. Analytic approximations are given for a qualitative survey of the numerical results. Microtrons, mesotrons, synchrotrons, cyclotrons, storage rings, and linacs are considered. Author (NSA)

N71-20823# National Bureau of Standards, Boulder, Colo. Atomic Frequency and Tiem Standards Section.
THE ION STORAGE TECHNIQUE FOR APPLICATION IN FREQUENCY STANDARDS
Helmut Hellwig Nov. 1970 26 p refs
(NBS-TN-388) Avail: SOD $0.35 Catalog No. C13.46:388

The basic technique of trapping ions in a quadrupole configuration driven by a radio frequency field is described. Relationships between the trap size, ion oscillation frequency, frequency and amplitude of the rf driving field, depth of the potential well, and the storage capacity are given, and a possible trap configuration is numerically evaluated. The effects of collisions, rf heating, and the loss of ions from the trap are briefly discussed. The second order Doppler effect is identified as the most serious accuracy limitation, whereas electric and magnetic fields as well as ion collisions are not expected to impose any accuracy limitation worse than 10 to the minus 14th power. The frequency stability performance of an ion storage device is estimated to be of the same order as for conventional atomic frequency standards. The ion storage technique thus is seen as a promising candidate for a primary frequency standard if further experimental research leads to a control of the second order Doppler effect. Author

N71-20826# Rensselaer Polytechnic Inst., Troy, N.Y.
A STUDY OF THE PULSE RADIOLYSIS OF GASES Annual Technical Progress Report
P. Harteck and S. Dondes Nov. 1970 26 p refs
(Contract AT(30-1)-3821)
(RPI-3821-5) Avail: NTIS

Primary emphasis in the past year was on modification of the pulsed source of radiation and in the detection system. Initial experimentation was begun on techniques for design of experiments on studies for pulse radiolysis systems. NSA

N71-20827# Sandia Corp., Albiquerque, N.Mex.
THE DIFFERENTIAL IONIZATION CROSS SECTION IN THE BORN APPROXIMATION
E. J. McGuire Dec. 1970 22 p refs
(SC-RR-70-773) Avail: NTIS

An expression for the ionization cross section differential in secondary electron energy and angle and projectile angle is described. The results are obtained for the Born approximation without exchange, and for a one-electron system. Author (NSA)

N71-20835# Los Alamos Scientific Lab., N.Mex.
VELA 5 AND 6 SOLAR X-RAY ATLAS. VOLUME 2: 1 SEPTEMBER 1969 - 1 JANUARY 1970
N. K. Blocker, P. E. Fehlau, W. E. Kunz, W. H. Chambers, J. C. Fuller et al Oct. 1970 124 p refs
(Contract W-7405-eng-36)
(LA-4454-Vol-2) Avail: NTIS

Data obtained from the solar radiation monitors on the Vela V Satellites are presented. Equivalent graybody flux in three bands (0.2 to 2, 1 to 8, and 1 to 16 A) is plotted as a function of universal time, one day per page. Data from September 1, 1969, to January 1, 1970, are presented. Author (NSA)

N71-20836# Minnesota Univ., Minneapolis. School of Physics.
NEGATIVE PION PROTON CHARGE EXCHANGE AT BACKWARD ANGLES
R. C. Chase, E. Coleman, H. W. J. Courant, E. Marquit, E. W. Petraske et al [1970] 50 p refs
(COO-1764-113) Avail: NTIS

Results of a measurement of the negative pion proton charge-exchange process at backward angles are presented. Differential cross sections were measured in the angular region $-0.5 < \cos\text{Theta} < -1.0$ at incident momenta of 2, 3, 4, 5, 6 GeV/c. The 6 GeV/c data were combined with existing measurements of the differential cross sections for backward positive pion proton and negative pion proton elastic scattering to yield values for the isotopic spin 1/2 and 3/2 u-channel and s-channel amplitudes for backward pion nucleon scattering and for the magnitude of the phases between them. It is found that the u-channel amplitudes can be explained by pure Regge pole exchange only near the extreme backward direction, but that a Reggeized absorption model agrees at least qualitatively with the data. The phase difference between the $I = 1/2$ and $3/2$ s-channel amplitudes is approximately 90 deg over the region $-0.8 < u < 0$ (GeV/c) squared. Author (NSA)

N71-20837# Oak Ridge National Lab., Tenn.
PROSPECTS OF A MULTI-MeV H2(+) INJECTION-ACCUMULATION EXPERIMENT
J. Rand McNally, Jr. Nov. 1970 21 p refs Presented at meeting on Div. of Plasma Phys., Washington, D.C.
(Contract W-7495-eng-26)
(ORNL-TM-3207; CONF-701114-1) Avail: NTIS

Crocker, Blow, and Watson discuss fusion reactors at approximately 200 kG, ion temperatures approximately 1 MeV, and lithium and deuterium as primordial fuel. The possibility of fusion start-up at MeV temperatures and more modest fields was discussed earlier. The prospects of a 2-mA, 4-MeV H2(+) injection-accumulation experiment at 10 to minus 8th power torr H2 in a 40/20 kG mirror field with 5.5-mm ECH (electron cyclotron heating) are presented. Such an experiment would test the basic principle of plasma exponentiation, which has yet to be demonstrated in injection-accumulation experiments. Author (NSA)

N71-20838# Purdue Univ., Lafayette, Ind.
THE ANALYTIC STRUCTURE OF THE OFF-MASS-SHELL S-WAVE PION(+) PION(-) SCATTERING AMPLITUDE
L. J. Gutay, J. H. Scharenguival, and F. T. Meiere (Indiana Univ.-Purdue Univ., Indianapolis) [1970] 8 p refs
(Contract AT(11-1)-1428)
(COO-1428-239) Avail: NTIS

Using rather general assumptions, it is shown that the on-mass-shell P-wave determines the off-mass-shell dependence of the S-wave positive pion negative pion amplitude. This is used to determine (2a sub 0 + a sub 2)/a sub 1 experimentally. Author (NSA)

N71-20839# Minnesota Univ., Minneapolis.
REACTION PION(−) PROTON YIELDS NEUTRON PION(+) PION(−) AT HIGH MOMENTUM TRANSFER
H. F. Romer, R. C. Chase, E. Coleman, H. W. J. Courant, E. Marquit et al [1970] 9 p refs
(Contract AT(11-1)-1764)
(COO-1764-114) Avail: NTIS

The production of pion(+) pion(−) pairs in the backward hemisphere of the reaction pion(−) proton yields neutron pion(+) pion(−) was studied at incident pion momenta of 2, 3, 4, 5, and 6 GeV/c. The process is dominated by rho meson(0) and F(0) production. Differential cross sections and density matrix elements are presented. Author (NSA)

N71-20840# Oak Ridge National Lab., Tenn. Physics Div.
EIGENVALUES, RADIAL EXPECTATION VALUES, AND POTENTIALS FOR FREE ATOMS FROM Z = 2 TO 126 AS CALCULATED FROM RELATIVISTIC HARTREE-FOCK-SLATER ATOMIC WAVE FUNCTIONS
T. A. Carlson, C. C. Lu, T. C. Tucker, and C. W. Nestor, Jr. Dec. 1970 267 p refs
(Contract W-7405-eng-26)
(ORNL-4614) Avail: NTIS

Relativistic Hartree−Foch−Slater wave functions have been calculated for all elements from Z = 2 to 126. From these wave functions, the eigenvalues and expectation values of r, 1/r, 1/r(3), r(2) and r(4) for each orbital, the total energy of the atom, and the total potential as a function of radius were obtained. The potential is broken down into contributions from the nucleus, the electrons, and exchange. The results are presented in tables. Author (NSA)

N71-20845# Illinois Univ., Urbana.
ON THE COHERENCE OF ISOSCALAR AND ISOVECTOR EXCHANGE AMPLITUDE IN PION (+ OR −) PROTON YIELDS A2(+ or −) PROTON
D. V. Brockway, G. Ascoli, L. Eisenstein, M. L. Ioffredo, and U. E. Kruse Oct. 1970 11 p refs Presented at Meeting of the Div. of Particles and Fields of the Am. Phys. Soc., Austin, Tex. Sponsored by AEC
(COO-1195-202) Avail: NTIS

A study of pion (+ or −) proton yields pion (+ or −) pion(−) pion (+) proton at incident pion momenta from 5 to 8.5 GeV/c and comparison with published data on pion(+) neutron yields A2(0) proton indicate that charged A2 production involves both isoscalar and isovector exchange amplitudes of comparable magnitude. There appears, however, to be very little, if any, interference between these amplitudes thus leaving unexplained the difference between A2(+) and A2(−) mass spectra recently reported. Author (NSA)

N71-20903# Pittsburgh Univ., Pa. Dept. of Physics.
HIGH ENERGY PHYSICS AT THE UNIVERSITY OF PITTSBURGH Progress Report, 1 Dec. 1969 - 1 Dec. 1970
Nov. 1970 22 p refs
(Contract AT(30-1)-3829)
(NYO-3829-64) Avail: NTIS

Summaries are given of the research which includes weak interactions, quantum field theory, group theory, quantum mechanics, and mathematical physics. A list of publications is given. NSA

N71-20930# California Univ., Los Angeles. School of Engineering and Applied Science.
SCATTERING OF ARGON BEAMS WITH INCIDENT ENERGIES UP TO 20 eV FROM A (III) SILVER SURFACE
William Joseph Hays Jul. 1970 115 p refs
(Grants NSF GK-1854; NSF GK-15242)
(UCLA-eng-7061) Avail: Issuing Activity

A helium-argon mixture was arc-heated, expanded in a free jet, and collimated to form a nearly monoenergetic beam with argon energies up to about 20 eV per atom. A (111) silver surface (at least initially relatively uncontaminated) was prepared by epitaxially depositing silver vapor on a mica substrate maintained at about 300 C. The incident beam was characterized using time-of-flight techniques and the surface was characterized in situ by observing the angular distribution of a room temperature helium beam scattered from the surface. The appropriate species was detected using a quadrupole mass spectrometer. A new method is presented for removing the electronic distortion of the detection system from the detected signal. The argon scattering distribution was determined to be a specularly directed single lobe. It was found that bombarding the surface with a relatively high-energy argon beam significantly reduced the width of the scattering distribution realized for the probing room temperature helium beam. Author

N71-20932# Technische Hogeschool, Delft (Netherlands). Afdeling der Technische Natuurkunde.
GAMMA RAYS FROM Al-28, Re-186, Re-188, Th-233, AND Pa-233, FOLLOWING NEUTRON CAPTURE
Willem Hoekstra (Ph.D. Thesis) 1969 87 p refs
Avail: NTIS

A neutron capture gamma ray experiment was arranged at the tangential beam tube of a nuclear reactor. By using a lithium-drifted germanium detector single gamma ray spectra were measured of the reactions Al-27(n, gamma)Al-28, Re-185, Re-187, and Th-232(n, gamma)Th-233. The reaction Cl-35 (n, gamma)Cl-36 was used for calibration. ESRO

N71-20933# Pennsylvania Univ., Philadelphia. Dept. of Physcis.
BOOTSTRAPS IN LOCAL FIELD THEORY
M. L. Whippman 10 Dec. 1970 22 p refs Sponsored in part by AEC
(NYO-2171-331) Avail: NTIS

The problem of formulating a bootstrap in terms of vanishing renormalization constants is discussed. It is pointed out that the equations Z = 0 need not determine masses and coupling constants, but might be identities or else possess no solution. It is argued that this always occurs in theories in which particles are treated as made up of arbitrarily many other particles and this is illustrated in a soluble model. Finally, various consequencies of this idea are mentioned. Author (NSA)

N71-20934# Columbia Univ., New York.
REMARKS ON THE DELTA 1 ABSOLUTE VALUE EQUALS 1/2 RULE IN NONLEPTONIC WEAK DECAYS AND THE USE OF THE PHENOMENOLOGICAL LAGRANGIAN
T. D. Lee May 1970 62 p refs Sponsored by AEC
(BNL-50260) Avail: NTIS

It is shown that the validity of the usual "soft-pion" limit and the existence of a Delta 1 absolute value = 1/2 rule for nonleptonic weak interactions are two independent assumptions. The alleged derivation of the Delta 1 absolute value = 1/2 rule for nonleptonic kaon decays by using the "soft-pion" phenomenological Lagrangian models for nonleptonic kaon decays concerning the origin of the Delta 1 absolute value = 1/2 rule is analyzed. Author (NSA)

N71-20935# Rome Univ. (Italy). Inst. of Physics.
A STUDY OF KKPI FINAL STATES FOR NN ANNIHILATION AT REST IN THE VENEZIANO LANGUAGE

G. Benfatto, M. Cassandro, M. Lusignoli, and F. Nicolo 8 Jul. 1970 33 p refs *Its* Nota Interna No. 277
Avail: NTIS

The NN approaches limit of KKPI process in terms of four point Veneziano functions is studied. A duality breaking correction term is added to describe the alternate theta bump. The theoretical mass spectra and angular distributions are in good qualitative agreement with the experimental data. The relevance of daughter resonances, a specific feature of any Veneziano model, has been evaluated and could explain the discrepancies between theoretical and experimental bumps. Author (ESRO)

N71-20936# Rome Univ. (Italy). Inst. of Physics.
NUCLEAR FORCES AND SATURATION
F. Calogero (Inst. of Theoret. and Exptl. Phys.) 6 Jul. 1970 29 p refs Presented at the 2d Probl. Symp. on Nucl. Phys., Novosibirsk, USSR, 12–19 Jun. 1970 *Its* Nota Interna No. 274
Avail: NTIS

The rigorous conditions that the nuclear interaction must satisfy to be consistent with saturation are described. The implications of these results to current models of the nuclear force are assessed. Author (ESRO)

N71-20939# Ballistic Research Labs., Aberdeen Proving Ground, Md.
PULSE RADIOLYSIS TECHNIQUES
Nathan Klein and Theodore J. Rock Nov. 1970 44 p refs
(AD-717243; BRL-1508) Avail: NTIS CSCL 7/5

The report deals with the development of advanced pulse radiolysis techniques. Design parameters for light sources, detectors and data recording systems are discussed and an analytical array is described that makes possible the acquisition of spectral data with high sensitivity and nanosecond resolving time. Author (GRA)

N71-20944*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
N2(+) POTENTIAL ENERGY CURVES
James R. Stallcop 15 Mar. 1971 13 p refs
(NASA-TM-X-66898; A-3798) Avail: NTIS CSCL 20H

A valence-bond method is used to determine a set of relations between the potential energies of those states of N2(+) from which dissociation to ground state N and ground state N(+) takes place. The potential curves of the sextet and the quartet states are calculated at intermediate internuclear separation distances (2 A to 3.5 A) from these relations and the experimental curves of the doublet states. Author

N71-20950# Sandia Corp., Albuquerque, N.Mex.
RANGE-ENERGY RELATIONS FOR HELIUM IONS AND PROTONS IN N2, O2, AND AIR (0.2 TO 2.0 MeV)
Robert A. Langley Nov. 1970 22 p refs Sponsored by AEC
(SC-RR-70-788) Avail: NTIS

The ionization extrapolated ranges of H(+) and He(2+) in N2, O2, and air were measured from 200 keV to 2.0 MeV with an accuracy of + or - 1%. A magnetically analyzed beam of ions was brought through a differential pumping system into a gas-stopping cell. A single-grid ionization chamber, movable parallel to the beam axis, was used to obtain the data necessary to plot a Bragg curve. The observed range - energy relations are compared with previous data where possible. Author (NSA)

N71-21021# Gulf General Atomic, San Diego, Calif.
INTEGRAL NEUTRON THERMALIZATION Quarterly Progress Report, 1 Apr. -30 Jun. 1970
E. L. Slaggie and D. H. Houston 10 Jul. 1970 18 p refs
(Contract AT(04-3)-167)
(GA-10223) Avail: NTIS

Research progress in integral neutron thermalization studies 30 June 1970 in the period 1 April 1970 through 30 June 1970 is summarized. NSA

N71-21022# Rensselaer Polytechnic Inst., Troy, N.Y.
LINEAR ACCELERATOR PROJECT Progress Report, 1 Apr. -30 Jun. 1970
30 Jun. 1970 104 p refs
(Contract AT(30-1)-328)
(RPI-328-190) Avail: NTIS

Progress is summarized for neutron cross section measurements reactor fuel, structural materials and experimental and theoretical fast reactor physics studies. NSA

N71-21023# Oak Ridge National Lab., Tenn.
CALCULATED NEUTRON FLUX DISTRIBUTION RESULTING FROM A FISSION SOURCE LOCATED AT THE CENTER OF A 10 METER DIAMETER SPHERE OF SODIUM
C. L. Thompson 27 Oct. 1970 26 p refs Sponsored by AEC
(ORNL-TM-3156) Avail: NTIS

A Monte Carlo calculation using the O6R code was made to determine the neutron flux distribution resulting from a point isotropic fission source located at the center of a 10-meter-diameter sphere of sodium. The purpose was to obtain data that will be helpful in evaluating the accuracy of calculations involving neutron transport in sodium. Author (NSA)

N71-21037# Oak Ridge National Lab., Tenn.
NEUTRON ELASTIC AND INELASTIC SCATTERING CROSS SECTIONS FOR YTTRIUM IN THE ENERGY RANGE 4.19 TO 8.56 MeV
F. G. Perey and W. E. Kinney Dec. 1970 52 p refs
(Contract W-7405-eng-26)
(ORNL-4552) Avail: NTIS

Numerical values are presented for neutron elastic- and inelastic-scattering cross sections for yttrium for incident neutron energies from 4.19 to 8.56 MeV. The data are in good agreement with the results of others. Author (NSA)

N71-21052# Stanford Linear Accelerator Center, Calif.
THEORIES OF HIGHLY INELASTIC ELECTRON SCATTERING
C. H. Llewellyn Smith Nov. 1970 22 p refs Presented at the meeting of the Div. of Particles and Fields of the Am. Phys. Soc., Austin, Tex., 5 - 7 Nov. 1970 Sponsored by AEC
(SLAC-PUB-843; CONF-701108-3) Avail: NTIS

The review of highly inelastic electron scattering covers the Parton model, survival of resonance contributions at large sq q Regge behavior, finite energy sum rules and fixed poles, recent e N research, and related processes. NSA

N71-21058# Houston Univ., Tex.
PION INTERACTIONS AT MEDIUM ENERGIES Progress Report
John C. Allred and Clark Goodman 1 Jan. 1971 25 p
(Contract AT(40-1)-3948)
(ORO-3948-2) Avail: NTIS

The summary of research given includes the small-angle scattering of protons and positive pion and negative pion, data analysis programs, incident pion flux measurements, and the development of scintillation counters. A list of presented papers is included. NSA

N71-21059# Minnesota Univ., Minneapolis. School of Physics.
THEOREM ON INTUITIVE TESTS OF PARITY CONSERVATION VIA SPIN POLARIZATION PROCESSES

Robert M. Saenger [1969] 15 p refs
(Contract AT(11-1)-1764)
(COO-1764-100) Avail: NTIS

Working in the helicity formalism it is shown that if parity is violated in a nontrivial way by the amplitudes for a two-body scattering reaction, then at least one of the parity violating polarization correlation measurements, all of which would vanish in the case of parity conserving amplitudes, is nonvanishing. This type of result is more general than the specific case considered and applies, for example, to decay processes as well. Author (NSA)

N71-21083*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EPR STUDY OF ELECTRON IRRADIATED LiF
R. A. Lad and G. C. Fryburg 1971 5 p refs Presented at Am. Phys. Soc. Meeting, Cleveland, 29 Mar. –1 Apr. 1971
(NASA-TM-X-52989; E-6229) Avail: NTIS CSCL 20H

Electron bombardment causes the release to the vapor phase of alkali metal and halogen as neutrals, the halogen being more abundant, in the range from room temperature to 573 K. The LEED and Auger studies of others suggest that the surface defects generated are mainly halogen ion vacancies and postulate that the additional nucleation sites formed are clusters of these vacancies. It was of interest to see whether surface F-centers might also be produced. The detection technique used was EPR, which might be expected to detect the presence of free alkali metal if it exists in the proper state of subdivision. The preferential loss of halogen to the vapor might presuppose the retention of alkali metal on the surface. Author

N71-21132# Oak Ridge National Lab., Tenn.
GLOVE BOX VACUUM SYSTEM FOR RADIOISOTOPIC TARGETS
J. R. Gibson Jan. 1971 11 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3209) Avail: NTIS

Several vacuum systems are being used for the fabrication of accelerator and reactor targets from radioisotopes of some of the heavy elements. These vacuum systems are enclosed in glove boxes to provide containment for the alpha particle emitting radioisotopic elements being handled. The requirements for the variety of highly specialized target forms which the systems attempt to satisfy are discussed. Included are the several methods such as electron bombardment heating, levitation melting, and reduction distillation used to process the radioisotopic materials as well as the construction and operating features of the containing glove boxes and the oil diffusion vacuum systems. The operation and maintenance problems which have developed over the nearly three year period of use of the systems are also discussed. Author (NSA)

N71-21140# Institut Universitaire de Technologie, Nantes (France).
THEORY OF THE PHENOMENON OF SECONDARY ELECTRON EMISSION [THEORIE PHENOMENOLOGIQUE DE L'EMISSION ELECTRONIQUE SECONDAIRE]
M. Cailler *In* Ecole Natl. Super. de Mecan. Ann. of Mech. Semiann. Rept., 1969 p 205–215 refs In FRENCH (See N71-21133 10-32)
Avail: NTIS

An analytical expression of the secondary electron emission efficiency is given and its variations with the primary electron emission analyzed. Results are compared with known experimental results and found to be in good agreement. ESRO

N71-21147# Nebraska Univ., Lincoln. Behlen Lab. of Physics.
ASYMPTOTIC WAVE FUNCTIONS NEAR THRESHOLDS IN THE PRESENCE OF LONG RANGE POTENTIALS
Kenneth Smith 1970 23 p refs Sponsored in part by NSF Prepared in cooperation with Quantum Systems, Inc.
(Contract F29601-69-C-0046)
(AD-716833; Rept-70-120) Avail: NTIS CSCL 20/8

Many problems in non-relativistic collision theory reduce to the numerical solution of coupled systems of second order ordinary differential equations. Observables are related to the asymptotic characteristics of the solutions to these equations. In this paper, a new algorithm is presented for calculating the asymptotic solutions to such systems of equations at, and in the vicinity (above and below) of, thresholds. Author (GRA)

N71-21170# Minnesota Univ., Minneapolis. John H. Williams Lab. of Nuclear Physics.
[NUCLEAR SPECTROSCOPY AND EXPERIMENTAL INSTRUMENTATION]
Aug. 1970 184 p refs
(Contract AT(11-1)-1265)
(COO-1265-94) Avail: NTIS

Nuclear physics research, improvements to experimental instruments, and operating experience are described. Studies of the optical model of the nucleus by elastic scattering were continued. Energy levels of nuclei from boron through nickel were investigated by charged particle reactions produced by He-3, He-4, proton, and deuteron beams. Operating experience with the tandem Van de Graaff machine, proton linear accelerator, charged particle magnetic spectrometer, and the CDC-3100 computer is described. N.E.N.

N71-21171 National Lending Library for Science and Technology, Boston Spa (England).
NEW EXPERIMENTS ON RADIOACTIVATION ANALYSIS USING GAMMA PHOTONS OF 18 TO 27 MeV
E. Schweikert et al 10 Jul. 1970 20 p refs Transl. into ENGLISH from Proceedings of IAEA Colloq. on Radiochem. Anal. Methods (Salzburg), Oct. 1964 *Its* Paper SM-55/66
(NLL-CE-Trans-5113-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Experiments to examine the possibility of analysis by irradiation with gamma photons have shown that it should be possible, using a suitable instrument, to carry out a large number of high-sensitivity measurements, in particular on materials which are highly absorbent as regards neutrons (e.g. B, Cd, Hf, W, Mn) and measurements which are impossible with thermal or fast neutrons (e.g. Ti, Ni in Cu, as well as C, N, F, and O). Author

N71-21172# Oak Ridge National Lab., Tenn.
CURRENT NUCLEAR LEVEL SCHEMES: A = 91 TO 117. AN INVITATION TO PARTICIPATE
W. T. Bass, D. J. Horen, and W. B. Ewbank Dec. 1970 283 p refs
(Contract W-7405-eng-26)
(ORNL-4627) Avail: NTIS

Recent literature containing experimental nuclear structure data were scanned to extract level energies and spins and parities for nuclei in the mass region A = 91 to 117. A summary of current data for these nuclei is presented in the form of ladder diagrams and accompanying tables. These data were not thoroughly evaluated, but should provide useful level information in a mass region for which more thorough compilations are mostly outdated. Author (NSA)

N71-21182# Oak Ridge National Lab., Tenn.
DECAY SCHEMES OF Fe 59 AND Ir 192
Jean Legrand et al 1970 13 p refs Transl. into ENGLISH from Nucl. Phys. A (Amsterdam), v. 142, 1970 p 63 71
(ORNL-tr-2345) Avail: NTIS

Ir-192 to Pt-192 and Os-192 were investigated with calibrated Ge(Li) detectors. Transitions of Co-59 at 381 and 1481 keV were confirmed. The absolute intensities for gamma rays and beta transitions are deduced, particularly, the electron capture intensity in Ir-192: (4.7 · or 0.4)%. The K-capture probability is calculated: P sub K 0.811 · or 0.05. Author (NSA)

N71-21203# Johns Hopkins Univ., Baltimore, Md.
COHERENT ANTIPROTON DEUTERON INTERACTIONS AND RELATED DISSOCIATION REACTIONS AT 7.0 GeV/c
P. Antich, A. Callahan, R. Carson, C.-Y. Chien, B. Cox et al [1970] 45 p refs Sponsored in part by AEC and NSF Revised
(TID-25610; JHU-7009-Rev.) Avail: NTIS

In a 3.5 event/micro b exposure of the BNL 80 in. bubble chamber, the following reactions were observed: (1) antiproton deuteron yields anitproton deuteron positive pion negative pion, (2) antiproton deuteron yields antiproton proton neutron positive pion negative pion, and (3) antiproton deuteron yields antiproton deuteron positive pion negative pion neutral pion. The incident antiproton momentum was 7.0 GeV/c. Cross sections are given for the reactions, as well as for other reactions involving production of anti-Lambda hyperons. Detailed descriptions of the coherent final states are given. It is observed that the reactions are dominated by production of antidelta hyperon ( )(1236). Deck model, both in Reggeized and non-Reggeized form is applied to the reaction: antiproton deuteron yields antidelta hyperon ( ) positive pion deuteron, and satisfactory fits to the distribution of all kinematic variables were obtained. The predictions of the model agree well with the observed distributions of all the kinematic variables.
Author (NSA)

N71-21263# Washington Univ., Seattle.
FINITE NUCLEAR SIZE AND RADIATIVE CORRECTIONS IN THE CONSTRUCTION AND ASSESSMENT OF KURIE PLOTS FOR ALLOWED BETA-DECAY
D. H. Wilkinson [1970] 13 p refs Sponsored by AEC
(RLO-1388-131) Avail: NTIS

If only a small fraction of a beta spectrum is available for Kurie plot analysis because of the existence of strong branches of lower energy, it may become important to take into account finite nuclear size and radiative effects in the construction and assessment of the Kurie plot. Failure to do this may result in errors of many percent in the extraction of the high energy beta branch. These effects are analyzed, and numerical estimates are made of the possible errors.
Author (NSA)

N71-21264# California Univ., Los Angeles.
A STUDY OF THE DECAY MODE KAON(0) SUB L YIELDS PION(+) PION(−) PION(0)
C. D. Buchanan, D. J. Drickey, F. D. Rudnick, P. F. Shepard, D. R. Stork et al [1970] 12 p refs Sponsored in part by AEC and NSF Prepared in cooperation with Johns Hopkins Univ. and Stanford Linear Accelerator Center
(UCLA-1052) Avail: NTIS

The decay process was studied using a wire chamber magnetic spectrometer. The three pion decay was separated from leptonic decays using kinematics and muon identification. The average detection efficiency is 58.5% with a variation of less than 10% over the Dalitz plot.
Author (NSA)

N71-21265 Virginia Polytechnic Inst., Blacksburg.
DELAYED NEUTRON GROUPS FROM U 235 AND U 233 AND SHORT-LIVED DELAYED PHOTONEUTRON GROUPS FROM U 235 AND U 233 IN D2O
George Earle Rambo (Ph.D. Thesis) 1969 137 p
Avail: Univ. Microfilms: HC $6.60 Microfilm $3.00 Order No. 70-5364

The delayed neutron groups from U-233 and U-235 were studied using a rotating chopper method. The uranium targets were irradiated by a pulsed beam from a reactor and the neutron activity of the targets during the closed portion of the chopper rotation cycle measured as a function of time. The chopper and a multichannel analyzer were coordinated to allow rapid data accumulation by super-imposing data from successive chopper rotations. No shorter lived delayed neutron groups were found even though the experiment was capable of resolving half lives as short as a few milliseconds. A search for short-lived delayed photoneutron groups from U-233 and U-235 in D2O was made. The same experimental technique was used except that the uranium targets were mounted at the center of a sphere filled with D2O. No delayed photoneutron groups with significant abundance were found with half lives between 0.002 seconds and 10 seconds.
Dissert. Abstr.

N71-21306# Pennsylvania Univ., Philadelphia. Dept. of Physics.
GIANT MONOPOLE STATE: ISOSPIN MIXING IN NUCLEAR GROUND STATES
J. V. Noble [1970] 8 p refs Sponsored in part by AEC
(NYO-2171-330) Avail: NTIS

The Coulomb-induced Delta T = 1 admixture in nuclear ground states is evaluated by assuming that the mixing is entirely through a given giant monopole state.
Author (NSA)

N71-21322# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INTERACTION OF GASEOUS IONS WITH A METAL SURFACE
B. V. Fillippov 28 Oct. 1970 20 p refs Transl. into ENGLISH from Aerodinam. Razerzhennykh Gazov, Leningr. Gos. Univ., Nauchn.-Issled. Inst. Mat. i Mekhan. (Leningrad), no. 3, 1967 p 110–123
(AD-717063; FTD-HC-23-1191-68) Avail: NTIS CSCL 7/4

For collision of an ion with a metal surface, with reference to aerodynamic applications, the report examines the general problem of the physical mechanisms of the accompanying processes and the specific problem of the charge states of the gas particle and surface. The semi-empiric Hagstrum theory is discussed with correction of its internal contradictions. It is considered firmly established that ion neutralization by given metallic surfaces corresponds to the mechanism of Auger neutralization. The theory discussed permits calculation of aerodynamic values with good accuracy. It is found that practically all positive ions that collide with a pure metallic surface are neutralized. Secondary electrons must be taken into account in calculation of the charge state. A considerable part of the energy of ion neutralization and the energy of strongly excited atoms is converted to thermal energy, which can exceed ion kinetic energy at a velocity of about 8 km/sec.
Author (GRA)

N71-21337# Minnesota Univ., Minneapolis. School of Physics.
THEORETICAL AND HIGH ENERGY PHYSICS PROGRAMS Progress Report 1 Sep. 1969 – 31 Aug. 1970
31 Aug. 1970 55 p refs
(Contract AT(11-1)-1764)
(COO-1764-86) Avail: NTIS

Research in high-energy physics and nuclear physics is summarized. The nuclear research is theoretical, and the particle research is both theoretical and experimental. A list of publications is included.
NSA

N71-21374# Quantum Systems, Inc., Albuquerque, N.Mex.
RESONANT STRUCTURE OF LITHIUM BETWEEN THE 2 TRIPLET S AND 2 SINGLET P THRESHOLDS
Stephan Ormonde, John W. Cooper (NBS, Washington, D.C.), M. J. Conneely (Nebraska Univ.), and Kenneth Smith (Nebraska Univ.) 1970 12 p refs Supported in part by NSF
(Contract F29601-69-C-0046)
(AD-716832) Avail: NTIS CSCL 7/4

Close coupling calculations of the optically allowed states in the 60-70 eV range above the ground state of atomic lithium have been performed. An interpretation of the resonant structure in this region is given based upon these calculations and recent experimental evidence.
Author (GRA)

N71-21378# Brookhaven National Lab., Upton, N.Y.
EMPIRICAL NEUTRON TRANSMISSION COEFFICIENTS FOR HEAVY NUCLEI IN THE ENERGY REGION 0.05-2 MeV
P. E. Vorotnikov 1970 6 p refs Transl. into ENGLISH from At. Energ. (Moscow), v. 29, no. 48, 1970 6 p Sponsored by AEC
(BNL-tr-379) Avail: NTIS

Transmission coefficients are determined directly from experimental data for energies between 0.05 and 2 MeV from excited levels in Th-232 and U-238. Contributions from direct processes and fission were ignored. The cross sections calculated from these transmission coefficients are compared with experiment. NSA

N71-21379# Minnesota Univ., Minneapolis. Dept. of Chemistry.
VIBRATIONAL ANHARMONICITY AND ROTATION VIBRATION INTERACTION IN POLYATOMIC MOLECULES Final Report, 1 Oct. 1968-30 Sep. 1970
John Overend 15 Nov. 1970 9 p refs
(Grant AF-AFOSR-0570-67)
(AD-717194; AFOSR-70-2915TR) Avail: NTIS CSCL 7/4

Research on the vibrational anharmonicity of simple polyatomic molecules is reported. The work is partly in the determination of experimental spectra of CS2, CH31, CD31, and other simple molecules, and partly computational in that several models for the anharmonic part of the potential energy have been developed and tested against real experimental data. The conclusions are that many of the anharmonic effects in the vibrational spectrum can be modeled with a Morse function for the bond stretch coordinates and a curvilinear bending coordinate. Author (GRA)

N71-21380# WADCO Corp., Richland, Md.
COMPARISON OF NUCLEAR DESIGN MODELS FOR POWER AND FLUX DISTRIBUTIONS NEAR THE FTR CORE REFLECTOR INTERFACE
L. D. Oidell and R. B. Rothrock Nov. 1970 20 p refs
(Contract AT(45-1)-2170)
(WHAN-FR-35) Avail: NTIS

Diffusion and transport (Sn) calculations in one and two dimensions are described. The model detail required to accurately calculate flux and power distributions near the Fast Test Reactor (FTR) core-reflector interface is analyzed. Author (NSA)

N71-21388# Oregon Univ., Eugene.
BOOTSTRAP THEORY OF VIBRATIONS IN NUCLEI
Orhan Nalcioglu (Ph.D. Thesis) Sep. 1970 132 p refs
(RLO-1925-46) Avail: NTIS

The bootstrap theory of vibrations is formulated for nuclei, first for the closed-shell region, and it is shown how the ground state correlations for the odd mass nuclei must be taken into account. The modification of single particle spectroscopic factors and particle-hole splittings is explicitly demonstrated. The Random Phase Approximation (RPA) is obtained in the weak coupling limit. The theory is then applied to heavy spherical nuclei in the quasi-particle representation. The development of the quadrupole moment for the 2(+) state is demonstrated, and the quadrupole moment is calculated for Pd-110. The effect of core anharmoniticity on the odd-mass spectrum is also pointed out. In the weak coupling limit the QRPA is again obtained. The boostrap theory is next developed for the pairing vibrations; in the strong coupling limit, it gives rise to the BCS theory except for a better treatment of the number problem. NSA

N71-21390# Avco-Everett Research Lab., Everett, Mass.
ARC STUDY OF THE OXYGEN SCHUMANN-RUNGE SYSTEM
Kurt L. Wray and Stephen Fried Dec. 1970 31 p refs Submitted for publication
(Contract F04701-70-C-0128; ARPA Order 1092)
(AD-717161; AERL-RR-354; SAMSO-TR-70-338) Avail: NTIS CSCL 7/4

Other investigations have shown that the Schumann-Runge system of oxygen is excited by an inverse predissociation mechanism, O + O yield O2*. Under the condition where this excitation mechanism dominates, there is some question as to whether the radiation yielded a true rotational/vibrational electronic band spectrum, as opposed to a recombination continuum. Furthermore, there is a controversy as to whether the spectral intensity is that given by equilibrium theory. The present work utilized a 1 atm arc jet facility to heat air and O2-noble gas mixtures to temperatures between 3000 and 3500K. Both photographic and photoelectric spectra were recorded. In the latter case, wavelength scans from 2000 to 6000 A were carried out with 5 A resolution to obtain absolute intensity data. The spectra were found to have true rotational/vibrational electronic band structure, and were identified as the O2 Schumann-Runge system. Comparison with an equilibrium radiation model showed excellent agreement. A slight adjustment was made in the electronic transition moment for the NO(beta) system as demanded by the air runs. Author (GRA)

N71-21400# Quantum Systems, Inc., Albuquerque, N.Mex.
ON THE THEORY OF LOW-ENERGY ENCOUNTERS BETWEEN ATOMIC SYSTEMS
Kenneth Smith 1970 24 p refs Prepared in cooperation with Nebraska Univ.
(Contract F29601-68-C-0052)
(AD-716831; Rept-70.096) Avail: NTIS CSCL 7/4

The theory of fine structure transitions in atom-atom collisions, developed by Allison and Burke, is generalized to allow the wave functions of the colliding systems to be described by linear superpositions of electronic configurations employing orbitals distinct where necessary. Author (GRA)

N71-21440 Denver Univ., Colo.
MICROSCOPIC THEORY OF QUASIPARTICLE SPIN FLUCTUATIONS IN A FERMI LIQUID
Linda Elizabeth Reichl (Ph.D. Thesis) 1969 170 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 70-5733

Low temperature, dense Fermi liquids were examined from both a semi-phenomenological and a microscopic point of view. Closed form expressions for the grand potential, the total energy, the quasi-particle energy, the interaction energy, and the entropy, were obtained in terms of the vertex function. This vertex function, and the above quantities can be calculated from the interaction potential between constituent particles in the liquid. The relation between the Landau theory and fluctuation theory was clarified through analysis of the microscopic theory. Dissert. Abstr.

N71-21549# Maryland Univ., College Park. Dept. of Physics and Astronomy.
AN ANALYSIS OF STORMS WITH FEW MUONS [UN ANALISIS DE CHUBASCOS POBRES EN MUONES]
I. Escobar, M. La Pointe, and G. B. Yodh *In* Univ. Mayor de San Andres Sum of Res. Proj. for 1969, no. 33 Feb. 1970 p 108-119 refs In SPANISH Presented at the 11th Intern. Conf. on Cosmic Radiation, Budapest, Aug. 1969 (See N71-21545 10-29)
Avail: NTIS

The muon content of 14,000 storms with low muon content was studied. It was found that there is a radial dependence of muon distribution, and the content depends on the size of the storm. Transl. by F.Q.S.

N71-21562*# Oak Ridge National Lab., Tenn.
NUCLEON-MESON TRANSPORT CODE (NMTC)

W. A. Coleman and T. W. Armstrong Oct. 1970 91 p refs
(NASA Order 38280A; Contract W-7405-eng-26)
(NASA-CR-117496; ORNL-4606) Avail: NTIS CSCL 20H

The nucleon-meson transport code NMTC computes the transport of nucleons below 3.5 GeV and muons and charged pions below 2.5 GeV. Monte Carlo methods are employed to provide a detailed description of the transport process. High-energy nucleon – nucleus and pion – nucleus collisions are treated using the intranuclear-cascade -evaporation model. Virtually arbitrary geometries can be specified. The code is written in FORTRAN IV for the IBM 360/75 and IBM 360/91 computers. The method of calculation used by the code is discussed., and the code input is described. Also, input and output for a sample problem are given.
Author (NSA)

N71-21591# Scientific Translation Service, Ann Arbor, Mich.
STUDY OF THE TANTALUM HYDROGEN SYSTEM: EQUILIBRIUM DIAGRAM AND ELECTRONIC STRUCTURE
F. Ducastelle et al Dec. 1970 13 p refs Transl. into ENGLISH from Phys. Chem. Solids (London), v. 31, 1970 p 1247 -1256 Prepared for Argonne Natl. Lab.
(ANL-TRANS-867) Avail: NTIS

The study of the electronic specific heat and of the magnetic susceptibility of Ta – H compounds was carried out in order to check the validity of the rigid d band model, which has already been put forward for several transition metals hybrides. The behavior of these compounds was shown to be quite similar to the behavior of the isoelectronic alloys Ta – W. During this work, some precisions had to be brought on some obscure points of the binary diagram Ta – H through resistivity and X-ray diffraction experiments. In particular, the solubility limits of the Ta-rich solid solution and of the orthorhombic compound near TaH(0.5) were determined.
Author (NSA)

N71-21592# Chicago Univ., Ill. Dept. of Chemistry.
EXPERIMENTAL AND THEORETICAL STUDIES OF MATERIALS AND RADIATION
Stuart A. Rice 17 Nov. 1970 26 p refs
(Contract AF-AFOSR-1663-69A; Grant AF-AFOSR-1663-69)
(AD-717182; AFOSR-70-2896TR) Avail: NTIS CSCL 7/4

Results of the research are subdivided into the following categories - (1) Transport of matter and energy, (2) Electronic structure of disordered systems, (3) Photochemistry, (4) Electronic structure of molecular crystals, (5) Theory of liquids and phase transitions, (6) Chemical control mechanisms, (7) General physical chemistry, especially reaction kinetics. The theme of the research was to construct experimental and theoretical studies of the interrelation between electronic structure, molecular structure and molecular motion. Phenomena dependent on these interrelations are reflected in material properties as diverse as the conductivity of liquid metals, photochemistry, phase transitions, etc.
Author (GRA)

N71-21635# Oak Ridge National Lab., Tenn.
INDEXED BIBLIOGRAPHY ON TRANSPORTATION AND HANDLING OF RADIOACTIVE MATERIALS, 2
R. D. Seagren and L. B. Shappert Jan. 1971 123 p refs
(Contract W-7405-eng-26)
(ORNL-NSIC-84) Avail: NTIS

Abstracts of articles associated with shipping containers, transport regulations, criticality in handling, and transportation accidents are presented. Indexes of keywords, authors, and report numbers are included.
NSA

N71-21636# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
RESEARCH AND DEVELOPMENT ACTIVITIES FIXATION OF RADIOACTIVE RESIDUES Quarterly Progress Report, Aug. – Oct. 1970
A. G. Blasewitz, ed. Nov. 1970 32 p refs
(Contract AT(45-1)-1830)
(BNWL-1533) Avail: NTIS

The full level radioactive demonstrations were successfully completed in WSEP with the ninth pot solidification demonstration. A total of 33 runs was made in which 52 million curies of radionuclides were converted to solids. During the report period, the seventh, eighth, and ninth pot solidification demonstration runs in WSEP were completed. During Runs PC-7 and PC-8, simulated Purex Wastes containing 2.6 megacuries of radioactivity were reduced to a calcine product. During the ninth and final pot solidification run the rising level glass concept was demonstrated in which a simulated Purex Waste was fed to the pot where it was continuously concentrated, calcined, and fused to a borosilicate glass product.
Author (NSA)

N71-21695# Tokyo Univ. of Education (Japan). Dept. of Physics.
HADRONIC SCATTERING AMPLITUDES IN THE QUARK MODEL 2: INTRODUCTION OF SPINS OF QUARKS AND ANALYTIC PROPERTIES OF DUAL AND DIFFRACTIVE AMPLITUDES
Tsunehiro Kobayashi Nov. 1970 60 p refs
(TUEP-70-35) Avail: NTIS

Dual and Diffractive amplitudes are discussed in the unified description in terms of the quark model. Introduction of spins and unitary spins of quarks and analytic properties of dual and diffractive amplitudes are investigated in the meson-meson and meson-baryon scatterings. It is indicated that there are some possibilities for the analytic properties of the dual H type diagram, i.e. not only the pole-pole correspondence like the Veneziano amplitude but also pole-cut correspondence and cut-cut one. The z type diagram in the meson-baryon scattering is also studied and it is shown that the Z type diagram leads to only the pole-pole duality like the Veneziano amplitude except fixed cuts in the spin part of the amplitude. As for the diffractive amplitudes, the generalized form of the Wu-Yang conjecture is derived. The baryon-antibaryon (baryon) scattering is also discussed.
Author

N71-21711# Johns Hopkins Univ., Baltimore, Md.
A MEASUREMENT OF THE FORM FACTORS FOR THE DECAY KAON(0) SUB L YIELDS PION MUON NEUTRINO
C.-Y. Chien, B. Cox, L. Ettlinger, L. Resvanis, R. A. Zdanis et al [1970] 12 p Sponsored in part by AEC and NSF Prepared in cooperation with Stanford Linear Accelerator Center and Calif. Univ., Los Angeles Revised
(UCLA-1054; JHU-7016-Rev.) Avail: NTIS

The decay process kaon(0) sub L yields pion muon neutrino was studied in a wire chamber experiment using the three-degree kaon(0) sub L beam. A sample of 26,500 kaon muon 3 events were identified to obtain information on the form factors associated with the V – A hypothesis for this decay. Expressing the energy dependence of the form factors the experiment yields the value lambda(+) = 0.08 + or – 0.01 and reveals a strong coupling between lambda(–) and zeta (0).
Author (NSA)

N71-21714*# Yale Univ., New Haven, Conn. Dept. of Chemistry.
A CROSSED BEAM STUDY OF THE REACTION N(+) + O2 YIELDS NO(+) + O
John C. Tully, Zdenek Herman, and Richard Wolfgang [1970] 23 p refs
(NGR-07-004-043)
(NASA-CR-117527) Avail: NTIS CSCL 20H

The reaction N(+) + O2 yields NO(+) + O was studied as a function of collision energy using the crossed beam apparatus EVA. This process is of considerable importance in the upper atmosphere. The system is also of particular interest because it may involve strong interactions between several intersecting or close-lying electronic surfaces of NO2(+). This is not the case for

previously well-studied ion-molecule reactions (e.g., Ar(+) + D2), the dynamics of which are closely represented by simple models dominated by long-range electrostatic forces (e.g. polarization-stripping). Beams of N(+) in the ground P(3) state were crossed with thermal O2 beams and the angular and velocity distributions of the NO(+) product measured. The reaction exhibits the asymmetric distribution characteristic of a direct process. Its translational exoergicity (Q) declines with energy, but above 5eV relative energy, becomes constant. These data were then corrected for angular and energy spreads of the beams. Author

N71-21721# Iowa Univ., Iowa City. Dept. of Chemistry.
ONE AND TWO ELECTRON TRANSFER REACTIONS Progress Report, 1 Mar. 1970–28 Feb. 1971
Gilbert Gordon 19 Nov. 1970 20 p refs
(Contract AT(11-1)-1780)
(COO-1780-14) Avail: NTIS

A systematic study is being made of electron transfer reactions that utilize oxygen-containing oxidizing agents and V(III), V(III), U(IV), and trisphenanthroline iron(II) as reducing agent. Mechanisms of the reactions of chlorine(III) with uranium(IV) were determined. The effect of sample reduction on diffusion coefficients of single crystals TiO2 was investigated. NSA

N71-21722# Brandeis Univ., Waltham, Mass. Dept. of Chemistry.
EFFECTS OF MERCAPTANS AND DISULFIDES ON PHOTOCHEMICAL AND HIGH ENERGY RADIATION INDUCED REACTIONS Progress Report
Saul G. Cohen 1 Nov. 1970 21 p refs
(Contract AT(30-1)-2499)
(NYO-2499-37) Avail: NTIS

Studies were made on the Co-60 gamma irradiation of 0.1 and 0.01 M sec-bulytamine in water and the solutions were analyzed for 2-butanol and 2-butanone. The results indicated that the radiolysis converts the amine to the ketone and ammonia; the ketone is reduced to the alcohol. Some experiments were also carried out on irradiation of aqueous diisopropylamine in presence and absence of 2-mercaptoethanol. In the absence of mercaptan, acetone and 2-propanol were found in approximately equal quantities initially, with 2-propanol exceeding acetone after irradiation for 1 hr. In the presence of mercaptan, acetone was depressed to about 0.1 the concentration in the absence of mercaptan, and 2-propanol appeared little affected. Studies were also made on photoreduction in aqueous systems. Data are given on the photoreduction and quenching of 0.003 M fluorenone by para-substituted dimethyl anilines in benzene. NSA

N71-21723# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
ON-LINE COMPUTER MONITORING OF PRESSURIZED ION EXCHANGE PROCESS
S. F. Peterson and M. A. Wakat 18 Aug. 1970 20 p Presented at the 160th Natl. Meeting of the Am. Chem. Soc., Chicago, 13–18 Sep. 1970
(Contract AT(07-2)-1)
(DP-MS-70-38; CONF-700911-1) Avail: NTIS

An on-line radiometric monitoring system has been developed to provide information for control of a pressurized ion exchange chromatographic process for the large-scale purification of Cf-252, Cm-244, and Am-243. The effluent stream from the ion exchange chromatography columns is monitored by: a BF3 neutron detector for detecting Cf-252 and Cm-244; a NaI scintillation detector used with a single-channel analyzer; and a low-energy Ge(Li) photon detector (700 eV resolution at 42.9 keV). Information from these detectors is interfaced to a PDP-9 computer with an 8k memory capacity. The system calculates and prints out (as frequently as every 30 sec) concentrations of the radionuclides from the complex gamma and X-ray spectrum of the Ge(Li) detector and the BF3 and NaI detector responses. Selected regions of the Ge(Li) pulse-height spectrum may be examined on an oscilloscope display. Data obtained from the computer system are compared with those from manual calculations. Author (NSA)

N71-21724# Argonne National Lab., Ill.
ANION EXCHANGE SEPARATION OF NEPTUNIUM FROM URANIUM AND THORIUM IN BASIC SOLUTION
A. P. Masino (Minnesota Univ., Minneapolis), K. A. Orlandini, S. Fried, and D. Cohen Oct. 1970 12 p refs
(Contract W-31-109-eng-38)
(ANL-7751) Avail: NTIS

The anion-exchange behavior of neptunium, uranium, plutonium, thorium, and several accompanying elements has been studied in an aqueous tetramethylammonium hydroxide (TMAH) medium and in this same basic medium containing various complexing agents. It has been found that the neptunium in the +5 oxidation state is not retained by Dowex-1 × 8 resin from slightly basic TMAH-citrate solution and is readily separated from uranium and thorium, which are retained by a column of this resin. Author (NSA)

N71-21731# Brookhaven National Lab., Upton, N.Y.
STUDIES OF THE CAPTURE CROSS SECTION OF Np-237 AND Am-241 IN DIFFERENT REACTOR SPECTRA
E. Hellstrand, J. Phelps, and C. Sastre Jun. 1970 14 p refs
(BNL-50242) Avail: NTIS

Reactor oscillator technique was used for studying the capture cross section of Np-237 and Am-241 in two different reactor spectra. Because of unforeseen difficulties in ascertaining accurate weights of the samples, separate values of 2200-m/sec cross section sigma sub 0 and the resonance integral RI could not be derived from the experiments. For the same reason no results could be obtained from measurements on Pu-238 and the Pu-239 substandard used for correcting the Pu-238 sample result for the Pu-239 contribution. Assuming sigma sub 0 = 169 + or − 5 b, a value of RI = 640 + or − 50 b was obtained for Np-237. For Am-241 the measurements yielded the relation RI = 6.1 sigma sub 0−2210 between the cross sections involved. The low-energy limit for RI is 0.55 eV. Author (NSA)

N71-21732# Indiana Univ., Bloomington. Dept. of Chemistry.
ALPHA-DEUTERIUM EFFECTS ON THE RATE OF SOLVOLYSIS OF A 2 ADAMANTYL SULFONATE ESTER
V. J. Shiner, Jr. and R. D. Fisher [1970] 9 p refs
(Contract AT(11-1)-1008)
(COO-1008-15) Avail: NTIS

Studies were made on the alpha-deuterium isotope effects on the rate of solvolysis of 2,2,2-trifluoroethylsulfonate (tresylate). The rate constants measured by the precise conductance method and isotope effects are tabulated. The isotope effects were exactly as predicted for the mechanism involving interconversion of ion pairs. This reaction does not involve solvent nucleophilic participation in the rate-determining step. In accord with this mechanism, the isotope is not dependent on solvent polarity or nucleophilicity in the range studied. There is no reason to suspect that, within this mechanism, the effect should be much different in any other solvent. NSA

N71-21738 Tulane Univ., New Orleans, La.
NUCLEAR ENERGY LEVELS OF Cs 133 AND Pr 141 FROM THE (n,n prime gamma) REACTION
Vibhakar Ratilal Dave (Ph.D. Thesis) 1969 81 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 70-6390

The nuclear energy levels of Cs-133 and Pr-141 were investigated by high resolution measurements of gamma rays

following neutron inelastic scattering. Data were taken at twenty neutron energies between 0.2 and 2.2 MeV for Cs-133 and at eleven neutron energies between 1.2 and 2.2 MeV for Pr-141. A 30 cc. Ge(Li) detector was used to detect the gamma rays. Monoenergetic neutrons were produced by the He-3 (p,n) He-3 reaction using a 3 MV Van de Graaff accelerator. A total of 41 gamma-rays from inelastic scattering were observed in Cs-133. The decay scheme below 437 keV has been established from earlier investigations but no information on levels above this energy has been reported. The present work is consistent with the earlier results and in addition new levels at 633, 706, 728, 768, 819, 872, 917, 942, 1090, and 1175 keV were assigned from threshold measurements, excitation functions, and energy sum considerations. A total of 34 gamma rays were observed in Pr-141 of which five were assigned to decays from new levels at 1856, 1974, 2017, and 2104 keV and from a tentative level at 1900 keV. Dissert. Abstr.

N71-21739 Ohio State Univ., Columbus.
THE SPIN DEPENDENT SCATTERING OF THERMAL NEUTRONS FROM POLARIZED NUCLEI IN MAGNETICALLY ORDERED SOLIDS
Alan John Markworth (Ph.D. Thesis) 1969 131 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 70-6828

An analytical study is presented of the spin dependent scattering of thermal neutrons from magnetically ordered solids at temperatures sufficiently low that polarization of atomic nuclei is induced. Polarization is assumed to occur through the magnetic hyperfine interaction between a nucleus and its atomic electrons. Neutrons are scattered both by atomic nuclei (spatially isotropic scattering) and the unpaired atomic electrons (anisotropic magnetic scattering). Two analytical approaches are followed, leading to consistent results. In the first, the polarization-dependent probabilities that a coupled neutron-nucleus spin system be in a given total spin state (characterized by a given scattering amplitude) are calculated. These probabilities are then used to evaluate the coherent scattering cross section characteristic of certain Bragg reflections for hypothetical antiferromagnetic and ferromagnetic crystals. In the second approach, the Born approximation is used to calculate the spin dependent scattering cross section for a more generalized magnetic crystal. Dissert. Abstr.

N71-21740 Georgetown Univ., Washington, D.C.
A STUDY OF THE B-11 (p,3 He-4) REACTION FOR PROTON-BEAM ENERGIES OF 0.675, 1.00, AND 1.388 MeV
Victor Elliot Alessi (Ph.D. Thesis) 1970 135 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 70-6338

The mode of decay of the reaction was found to be sequential at the energies studied. The width of the 2.9 MeV first-excited state Be-8 was studied and found to be 1.0 MeV. At kinematically allowed angles, an analysis of the shapes of the coincidence spectra, using Breit-Wigner line shapes, revealed the coherent interference of the first- and second-emitted He-4 particles from this reaction. A phenomenological model is proposed to explain the interference. Dissert. Abstr.

N71-21741 California Univ., Berkeley.
STRONG PION-ALPHA SCATTERING WITH ELECTROMAGNETIC CORRECTIONS
Ronald Arlie Christensen (Ph.D. Thesis) 1969 98 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 70-6076

Electromagnetic corrections to pion-alpha scattering for space-like q prime 2 are calculated to see if they can be used to determine r sub pi. The low momentum t-dependence of the off-shell strong amplitude used in this calculation is determined with the help of crossing symmetry, current algebra, and PCAC. The relativistic corrections are found to be just as important as those which are also included in nonrelativistic treatments. When only the nonrelativistic terms are used, the large value of r sub pi (2 to 3 fermis) obtained recently from positive pion alpha scattering is reproduced. Including the relativistic terms brings the resulting value of r sub pi down to approximately 1 fermi. This is consistent with the values obtained by using inelastic electron-proton scattering. The positive pion alpha results are quite sensitive to the details of the pion-alpha nuclear interaction, which is only roughly approximated. Dissert. Abstr.

N71-21742 Tulane Univ., New Orleans, La.
INTENSITIES IN ELECTRON DIFFRACTION
Wilmer Rudolph Bottoms, Jr. (Ph.D. Thesis) 1969 104 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 70-6381

A computational method for electron diffraction intensity calculations was developed utilizing n-beam theory. The scattering matrix formulation proposed by Sturkey was employed and the computational method was compared with calculations using both the kinematic approximation and the two-beam dynamical theory. Electron diffraction intensity calculations were performed on gold microcrystals whose crystallographic structure was known. The scattering matrix calculation were carried out using an IBM 7044 computer and the two other theories were applied to the crystal system using a Wang electronic calculator. The theoretical results were compared with experimentally observed diffraction patterns for the system of gold microcrystals. The primary defect in these crystals was a twin in the (111) planes and this twin was incorporated into the diffraction calculations. Dissert. Abstr.

N71-21749 Colorado Univ., Boulder.
A PRECISION DETERMINATION OF THE MAGNETIC MOMENT OF THE PROTON IN NUCLEAR MAGNETONS
Dell Orren Fystrom (Ph.D. Thesis) 1969 108 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 70-5846

A rectangular charge collecting omegatron with an uniform radio frequency electric field was used to measure the cyclotron resonance frequency of several different ions. Extrapolation to zero mass was used to correct for space charge shifts. The magnetic field was 16 kilogauss, and the homogeneity was 12 parts in a million over the region of ion cycling. Cyclotron resonance line widths of less than one part in 50,000 were observed for small radio frequency electric field amplitudes. For large amplitude fields trapezoidal line shapes were found. With this large radio frequency field amplitude, proton line shapes with asymmetries of approximately 30 parts in a million were observed. The asymmetries were larger for higher mass ions, but still relatively small. The value of the magnetic moment of the proton in units of the nuclear magneton, uncorrected for diamagnetism, was 2.792780. The 70% confidence estimate, including both random and systematic errors, is estimated to be 11 parts in a million. Dissert. Abstr.

N71-21753 Missouri Univ., Columbia.
THE RHO MESON AND PION-NUCLEON SCATTERING
John Roy Urani (Ph.D. Thesis) 1969 101 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 70-6644

The LSZ reduction of the S-matrix for quantum field theory in the Heisenberg picture is used in this thesis to evaluate the contribution of the rho meson to the calculation of low energy pion-nucleon partial wave scattering parameters. Two models are employed in the investigation. A rho meson exchange model is used along with the assumption of rho meson dominance of the isovector form factors to calculate the s and p-wave scattering lengths and s-wave effective ranges. Excellent agreement with

experiment is found using this model. A current algebra model is constructed and it is shown that the rho meson does not contribute to the scattering in the limit of massless pions. An equality is found which verifies the rho meson dominance assumption for the nucleon. Rho exchange and current algebra models are constructed for pion-pion scattering. Another relationship is found which verifies the rho meson dominance assumption for pions. Possible corrections to the rho meson dominance assumption for both pions and nucleons are discussed. Dissert. Abstr.

N71-21754 Vanderbilt Univ., Nashville, Tenn.
ENERGY LEVELS IN Ge 72 FROM RADIOACTIVE DECAY STUDIES OF Ga 72 AND As 72
Alfred Carl Rester, Jr. (Ph.D. Thesis) 1969 141 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 70-5461

Radioactive decay studies of Ga-72 and As-72 and the development of computer programs for the analysis of gamma ray spectra are reported. The following experiments were performed on the Ga-72 decay: (1) gamma ray singles spectrum measurements with a Ge(Li) X-ray spectrometer and a 30 cu cm Ge(Li) dectector; (2) internal conversion measurements with a Si(Li) detector; (3) gamma-gamma coincidence measurements with Ge(Li) detectors and a two-parameter analysis system; and (4) electron-gamma, delayed coincidence measurements with an anthracene detector and a 30 cu cm Ge(Li) detector. All of the measurements except the delayed coincidence were also made on the decay of As-72. Fortran programs were developed for rapid and accurate analysis of the gamma ray spectra. These programs determine the peak parameters, energies, and intensities of the majority of the photopeaks in a spectrum; place transitions in a known decay scheme; and search for new energy levels. Dissert. Abstr.

N71-21758 Vanderbilt Univ., Nashville, Tenn.
NaI(Tl)-Ge(Li) GAMMA-GAMMA DIRECTIONAL CORRELATION MEASUREMENTS OF M1-E2 MIXING IN THE DECAY OF VIBRATIONAL LEVELS IN Gd 154
Lapsley Craig Whitlock (Ph.D. Thesis) 1969 124 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 70-5430

A pulse height analyzer was used to select pulses which correspond to the energy of a strong gamma ray in the NaI detector. A coincidence signal generated when one of the selected pulses coincides (within the resolving time) with a pulse from the Ge(Li) detector, is used to gate a multichannel analyzer for storage of the coincidence spectra. The NaI detector is rotated through 90 deg, 135 deg and 180 deg. The coincidence intensities of various gamma rays thus were determined as a function of angle, and the directional correlation coefficients calculated. Directional correlation coefficients were obtained for the following transitions which are in direct coincidence with the 123-keV transition: 873, 1005, 1274, 1496 and 1597 keV; and for the following transitions which are in direct coincidence with the 248-keV transition: 444, 625, 757, 881, 893, 1188, and 1246 keV. Some previously proposed spins and parities were established here for the first time. Dissert. Abstr.

N71-21759 Vanderbilt Univ., Nashville, Tenn.
A PREACCELERATING SPECTROGRAPH FOR THE STUDY OF LOW ENERGY ELECTRON SPECTRA AND AUGER SPECTRA OF U 233, Te 125, Ag 109 AND Pt 195
Wendell Morse Pou, Jr. (Ph.D. Thesis) 1969 169 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 70-5419

A permanent magnet, semicircular spectrograph that records electron spectra in the energy range from about 2 keV to 40 keV is described. Instrumental momentum resolution is about 0.1%. Relative uncertainties of energy measurements and intensity measurements are approximately 0.2% and 20%, respectively. Photographic plates, which are commonly used to detect electrons in semicircular spectrographs, have very low sensitivity to low-energy electrons. To reduce the time required for proper exposure, the spectrograph has a cyclindrical accelerating chamber. It is shown that an accelerating field having cylindrical symmetry produces a negligible distortion of a spectrum. Measured energies and relative intensities of lines in the Auger spectra of U-233, Te-125, Ag-109, and Pt-195 are given, and comparisons of these measurements with theoretical values are made. Dissert. Abstr.

N71-21760 Vanderbilt Univ., Nashville, Tenn.
LEVELS IN MEDIUM WEIGHT EVEN-EVEN NUCLEI POPULATED BY: Cu 66, Ga 68, Cs 132, I 132
Hubert Kennon Carter (Ph.D. Thesis) 1969 168 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 70-5390

The levels were studied with Ge(Li) detectors operated in singles and coincidence mode in conjunction with a 4096-channel analyzer. A Ge(Li) detector coincidence system and a Si(Li) detector electron system were set up. Gamma-gamma coincidence and directional correlation experiments, and internal conversion coefficient measurements were carried out with these systems. The decay of Cu-66 to Zn-66 was studied in singles and coincidence modes; the population levels were measured and the spin of the 2372-keV level was determined to be 0. The gamma rays following the decay of Ga-68 were also studied in singles and coincidence modes, and the spin of the 1655-keV level was found to be 0. The level structure of Xe-132 was studied by the radioactive decay of Cs-132 and I-132; the energies and intensities of transition in Cs-132 decay were determined. The I-132 decay was studied with Ge(Li) detectors and also with a 30 cu cm Ge(Li)-3 x 3 sq in NaI detector multiparameter coincidence system. The K-conversion lines of transitions in the I-132 decay were measured, and all transitions have M1 and/or E2 multipolarities. Dissert. Abstr.

N71-21761# Tokyo Univ. of Education (Japan). Dept. of Physics.
ANALYTIC FORM OF MULTIPLE SCATTERING AMPLITUDES IN THE REGGE POLE MODEL
Sunao Sakai 1971 8 p refs
(TUEP-71-1) Avail: NTIS

Multiple scattering amplitudes are shown to play an important role in the high energy scattering. The eikonal approximation is made in order to derive the multiple scattering amplitudes and their contribution is obtained by the numerical integration over the intermediate momentum. The integration over the intermediate momentum is carried out analytically without making use of eikonal approximation. For the sake of convenience, the scattering of scalar particle is considered. Then the multiple scattering amplitudes are expressed by the convolutional integral. Author

N71-21763 California Univ., Berkeley.
PION-ALPHA SCATTERING AND THE PION FORM FACTOR
Michael Anthony Fainberg (Ph.D. Thesis) 1969 71 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 70-6095

A measurement of the pion (plus and minus) HE(4) scattering has been made at 53, 60, 68 and 75 MeV incident pion lab energy. The resulting differential cross sections are presented. An attempt has been made to extract the pion electromagnetic form factor using the difference in the pion (plus) and pion (Minus) cross sections which is sensitive to the coulomb contribution to the total scattering amplitude. An optical model potential was postulated for the nuclear part of the interaction. Various different methods have been used to extract the form factor, with a view to minimizing model dependence. The most detailed model available, using a method of analysis designed to reduce this dependence gives R equals 2.96 plus or minus 0.43F. Possible uncertainties in the model and its application are also discussed Dissert. Abstr.

N71-21764 Tulane Univ., New Orleans, La.
AN INVESTIGATION OF THE 5.96 MeV DOUBLET IN Be 10
Walter Henry Grant, III (Ph.D. Thesis) 1969 52 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 70-6399

The Be-9(d,p)Be-10 reaction was performed at an incident deuteron energy of 2.90 Mev. Particle-gamma correlations between the proton group populating the doublet at 5.96 Mev in Be-10 and the associated gamma decays were measured using a collinear geometry. Spin assignments of J = 1 and J = 2 were confirmed, and the multipole mixture of the transition from the J = 2 member of the doublet to the J(pi) = 2(+) first excited state was deduced to be E2/M1 = .11 + or − .05, and a positive parity was assigned to that member of the doublet. Shell model structure and the application of isospin to A = 10 nuclei are discussed. Dissert. Abstr.

N71-21765# Texas A&M Univ., College Station. Cyclotron Inst.
RESEARCH AND OPERATION OF THE TEXAS A AND M VARIABLE ENERGY CYCLOTRON Progress Report, 1 Jun. 1969 – 1 Jun. 1970
1 Jun. 1970 162 p refs
(Contract AT(40-1)-3398)
(ORO-3398-26) Avail: NTIS

Work was performed in nuclear physics on: (h,d) and (d,h) reactions on N = 50 nuclei, medium energy proton scattering, samarium isotope reactions, (p,t) and (p,d) reactions of N = 82 nuclei, resonance fluorescence of nuclear energy levels, heavy ion penetration, nucleon-nuclear scattering, particle-gamma correlation, Bethe stopping power formula, alpha transfer in s-d shell, lifetimes in Mo-92 and Zn-66, neutron deficient nuclei, three-body problem, and proton stripping in Tc-93 and Cl-33. Nuclear chemistry research topics were: Z-dependence of X-ray production, in-beam conversion of electrons, X-ray emission induced by alpha particles, X-ray production by charged particles, internal ionization during beta decay, and gamma rays and X-rays accompanying nuclear fission. G.G.

N71-21766 Vanderbilt Univ., Nashville, Tenn.
AN EFFECTIVE NUCLEON-NUCLEON INTERACTION FOR USE IN NUCLEAR HARTREE-FOCK CALCULATIONS
Charles William Nestor, Jr. (Ph.D. Thesis) 1969 155 p
Avail: Univ. Microfilm: HC $7.20/Microfilm $3.00 Order No. 70-5416

The primary emphasis was on the determination of parameters defining an effective interaction so that the values of the energy and density of infinite nuclear matter, as calculated in the Hartree-Fock approximation, would match the experimental values. The reason for this emphasis is the observation that two potentials of very different form and predicted two-body phase shifts gave almost identical shell-model wave functions and energy levels in selected finite nuclei when the parameters were adjusted to match the energy and density of nuclear matter. The requirement of fitting the energy and density of nuclear matter was satisfied, and some nuclear Hartree-Fock calculations with these potentials give good agreement with experiment for light spherical nuclei, so a misfit to the high-energy phase shifts is not a serious disadvantage. The predicted properties of heavier spherical nuclei, calculated in the Hartree-Fock approximation with the potentials reported, do not agree with experiment. Dissert. Abstr.

N71-21768 California Univ., Riverside.
ENERGY SPECTRUM OF THE PION(+) IN KAON(+) YIELDS PION(+) PION(0) PION(0) DECAY
Donald Craig Davison (Ph.D. Thesis) 1969 49 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 70-6348

The low energy portion of the tau prime spectrum was measured in emulsion and the high energy portion was measured in a heavy liquid bubble chamber. The final data consists of 642 events in emulsion and 3406 events in the bubble chamber. Fits have been made to several models including the linear spectrum and the Brown-Singer sigma-resonance. The data somewhat favors the sigma-resonance model. In the linear spectrum approximation the ratio of our tau prime slope to a recent measurement of the tau slope disagrees with a prediction of delta I = 1/2 rule by 5 standard deviations, indicating a violation of the delta I = 1/2 rule for three pion decay of the kaon. The difference between the Delta I = 1/2 rule prediction and experiment can be interpreted as a Delta I = 3/2 contribution. Dissert. Abstr.

N71-21769# Rome Univ. (Italy). Inst. of Physics.
PRELIMINARY RESULTS ON BHABHA SCATTERING, MUON PAIR ANNIHILATION AND HADRON PRODUCTION BY E(+), E(−) COLLIDING BEAMS IN THE GeV REGION
M. Conversi 15 Sep. 1970 55 p refs Presented at the Intern. School. of Subnucl. Phys. "Ettore Majorana" Erice, Italy, 17 Jul. 1970 *Its* Nota Interna No. 281/Rev
Avail: NTIS

Preliminary results are reported of an experiment carried out at the Frascati storage ring, Adone, to investigate wide angle Bhabha scattering (WABS: from 53 to 127 deg theta), annihilation into muon pairs and hadron production by electrons, positrons colliding beams of total energy ranging from 1.4 to 2.4 GeV. These reactions where studied at the same time and with the same apparatus, which consisted of a number of optical spark chambers and plastic scintillators, with electronic equipment suitable for time-of-flight and pulse-height measurements. A monitoring system based on small angle Bhabha scattering (from 3.5 to 6.1 deg theta) was also used during the runs to obtain an absolute determination of the luminosity of Adone. Author (ESRO)

N71-21770 California Univ., Riverside.
RISING REGGE TRAJECTORIES
Gary Martin Epstein (Ph.D. Thesis) 1969 125 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 70-6350

A bootstrap or unique calculation of a linearly rising Regge trajectory is attempted in a single-channel, single-trajectory model when postulates of analyticity permit dispersion relations to be separately written for both the trajectory and the logarithm of its associated reduced residue function. The trajectory is caused to rise by making two subtractions in its dispersion relation; the reduced residue is subtracted just once as in potential theory. For the case of the rho-trajectory, the two dispersion relations are coupled through elastic unitarity resulting in a rather complicated non-linear integral equation for the imaginary part of the trajectory which must be solved by numerical iteration on the computer. The value of one of the three arbitrary subtraction constants is fixed to make the trajectory pass through the rho. Dissert. Abstr.

N71-21771 California Univ., Berkeley.
DETERMINATION OF ANTIKAON NUCLEON ELASTIC SCATTERING AMPLITUDES
David Seal Bailey (Ph.D. Thesis) 1969 140 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 70-6056

A phase shift analysis was used to determine the KN elastic partial wave amplitudes below 1.4 GeV/c laboratory momentum. The analysis used a separation of the partial wave amplitudes into resonant and non-resonant parts. Several parametrizations of the background amplitudes were tried. The phase shift results for the non-resonant amplitudes indicate a dominance by the J = 1/2 states. The necessity for using known resonant states was demonstrated, the parity assignments of the more elastic resonances

were confirmed, and a new resonance in the P sub 01 state is suggested. As a partial validation of the parametrizations employed, and a precursor to a many channel analysis, a three channel S-wave model calculation was performed. Dissert. Abstr.

N71-21779# Chicago Univ., Ill. Dept. of Chemistry.
STUDIES OF (1) ACTINIDE AND LANTHANIDE IONS AND (2) ORGANIC MOLECULES IN TRIPLET STATES BY MAGNETIC RESONANCE METHODS
Clyde A. Hutchison, Jr. 16 Dec. 1970 14 p refs
(Contract AT(11-1)-294)
(COO-294-10) Avail: NTIS

Developments are reported for studies on: f electron systems in single crystals, including the electron nuclear double resonance (ENDOR) lines for La and Cl in single crystals of LaCl3 and study of photoexcited states of Nd(3+) and U(3+) ions in LaCl3 single crystals; and organic molecules in triplet states, including EPR spectra of benzene single crystals. NSA

N71-21791# Indiana Univ., Bloomington.
DEUTERIUM AND TRITIUM EFFECTS ON THE RATES OF ORGANIC REACTIONS Annual Technical Progress Report
Dec. 1970 5 p
(Contract AT(11-1)-1008)
(COO-1008-16) Avail: NTIS

The solvolytic reaction mechanisms for a series of primary and secondary propargyl derivaties were investigated in a series of ethanol-water, trifluoroethanol-water, and hexafluoroisopropyl alcohol-water solvents. The gamma- and in some cases beta and delta secondary deuterium isotope effects for these reactions were determined as were the yields of products. The steric result of substitution of chiral 3-butyn-2-yl p-bromobenzenesulfonate was determined through a range of solvents. The steric result of substitution in trifluoroacetolysis of chiral 2-octyl-p-bromobenzene sulfonate was also investigated. Gamma-deuterium isotope rate effects were also determined for two 1-adamantyl carbinyl derivatives. NSA

N71-21792# California Univ., Livermore. Lawrence Radiation Lab.
DISTRIBUTION AND REDISTRIBUTION OF AIRBORNE PARTICULATES FROM THE SCHOONER CRATERING EVENT
L. R. Anspaugh, P. L. Phelps, G. Holladay, and K. O. Hamby 13 Nov. 1970 21 p refs Presented at the 5th Ann. Health Phys. Soc. Midyr. Topical Symp. on Health Phys. Aspects of Nucl. Facility Siting, Idaho Falls, Idaho, 3–6 Nov. 1970 Submitted for publication Sponsored by AEC
(UCRL-72534; CONF-701106-5) Avail: NTIS

Project Schooner, a 31-kt nuclear cratering detonation, was conducted on December 8, 1968, at the Nevada Test Site. Twelve sampling stations consisting of 6 each, radistion activated, high volume air samplers were established on arcs 6 and 50 miles downwind from the detonation site. Two stations were located upwind. The air samplers were electronically programmed to operate in a sequential fashion. Intensive sampling extended up to 6 weeks following the event. More than 20 gamma-emitting radionuclides were identified in the airborne particulates by the use of a Ge(Li) detector. Several days after the event, W-181 was the predominant radionuclide detected, and served as a unique tracer. Half-life of suspended radioactive particulates was observed to be 38 days. Data showed that the passage of radioactive particulates does not occur as an abrupt event but that the air activity remains high for long periods of time after the detonation. Author (NSA)

N71-21797# Johns Hopkins Univ., Baltimore, Md.
STUDY OF THE REACTION KAON(−) NEUTRON YIELDS KAON(−) PION(−) PROTON AT 12.6 GeV/c
P. Antich, A. Callahan, R. Carson, C.-Y. Chien, B. Cox et al [1970] 27 p refs Sponsored in part by AEC and NSF Revised
(TID-25611; JHU-70-13-Rev) Avail: NTIS

From a 2.5 event/microbarns Kaon(−) deuteron exposure of the BNL 80" bubble chamber 351 events were obtained which successfully fit the reaction Kaon(−) d yields Kaon(−) pion(−) proton proton. The (proton pion(−)) mass spectrum exhibits a strong enhancement, centered at 1400 MeV and 400 MeV wide, which cannot be clearly resolved into individual resonances. The reaction is analyzed with a diffraction dissociation model and the relevant cross sections are given. From a study of the low Kaon(−) pion(−) mass region we find that the Kaon pion elastic scattering cross section in the isospin 3/2 state is of the order of 2 millibarns. Author (NSA)

N71-21808# Indiana Univ., Bloomington. Dept. of Chemistry.
THE DEPENDENCE OF SOLVOLYTIC ALPHA-DEUTERIUM RATE EFFECTS ON THE NATURE OF THE LEAVING GROUP
V. J. Shiner, Jr. and W. Dowd [1970] 7 p refs
(Contract AT(11-1)-1008)
(COO-1008-13) Avail: NTIS

Experimental observations that confirm and extend earlier theoretical predictions of how the characteristic maximum alpha-deuterium isotope effect on solvolysis rate varies as a function of leaving group are reported. Studies were made on 3-pentyn-2-toluenesulfonate bromide and iodide in aqueous ethanol and trifluoroethanol solutions. Since the large isotope effects found indicated little or no covalent attachment in the rate determining step, the simplest interpretation of these findings was that the rate determining step is the interconversion of two ion pairs and that the product forming step is nucleophilic attack on the second formed ion pair. NSA

N71-21814 California Univ., Berkeley.
TOPICS IN CURRENT ALGEBRA AND ELECTROMAGNETIC INTERACTIONS
Arnulf Rabi (Ph.D. Thesis) 1969 45 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 70-6195

The possibility that certain spectral sums might be dominated by a single-particle state is considered. The equations of motion for the currents between single particle states are sandwiched and the bilinear current terms are evaluated by inserting a complete set of intermediate states. When we apply this method to the energy momentum tensor we find lower bounds for the particle masses in terms of their form factors. By use of Reggeology and the Cottingham formula, the divergences of electromagnetic mass differences are isolated in Minkowski space. Sum rules are derived which are necessary and sufficient to cancel them. Dissert. Abstr.

N71-21815 Minnesota Univ., Minneapolis.
THE ELASTIC SCATTERING OF 39.6 MeV PROTONS BY THE NICKEL ISOTOPES
Henry Soehlke Liers (Ph.D. Thesis) 1969 116 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 70-5631

Proton elastic differential cross section and polarization measurements have been made on the isotopes of Ni-58, -60, -62, -64 at 39.6 MeV. These data have been analyzed using a standard optical model and two versions of a model recently proposed by Greenlees, Pyle, and Tang. From this analysis, information concerning variations of root-mean-square radii of the matter, neutron, and real central potential form factors in an isotopic sequence is extracted along with similar information concerning the integral over the volume of the potentials obtained. The cross sections and polarizations predicted by the models are compared with the data to determine if one model is preferred over the other. Dissert. Abstr.

N71-21826 Vanderbilt Univ., Nashville, Tenn.
DOUBLE PION PRODUCTION IN ANTIPROTON-DEUTERON AND PROTON-PROTON COLLISION AT 2.8 GeV/c
Thomas Benjamin Borak (Ph.D. Thesis) 1969 201 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 70-5388

An analysis was performed on three and four pronged events observed in the deuterium filled bubble chamber exposed to 2.8 GeV/c antiprotons. The reactions of interest are those where two pions are produced in the final state without annihilation. A similar double pion final state produced in proton-proton collisions at the same energy is also studied. The data appear to be consistent with the production of a resonance of mass 1400 MeV and width 80 MeV which decays isotropically into N*(1238)pion. Dissert. Abstr.

N71-21828 Colorado Univ., Denver.
APPLICATION OF FLOQUET THEORY TO THE CALCULATION OF RESONANCE FREQUENCIES AND DISPERSION RELATIONS
John George Ross (Ph.D. Thesis) 1969 188 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 70-5889

Floquet's theorem, as applied to a system of simultaneous first order linear differential equations with periodic coefficients, is used to obtain explicit expressions for the characteristic exponents in terms of infinite determinants. This is applied to the time dependent Schroedinger equation for a particle in a general periodic magnetic field. Calculations are presented for the case when the particle has an intrinsic magnetic moment and when it has in addition an orbital angular momentum with vector L cross vector S coupling. Resonance frequencies, line widths, and a generalized Rabi formula are obtained. Magnetic moments are calculated and these are used as sources in Maxwell's equations to yield dispersion relations for propagation of electromagnetic waves in a paramagnetic medium. The fluctuation scattering produced by these sources is investigated. Solutions of the Bloch equation are also presented. Dissert. Abstr.

N71-21829 California Univ., Riverside.
SOME ASPECTS OF REGGE POLE CONSPIRACY IN NUCLEON-NUCLEON SCATTERING
Bimal Kumar Pal (Ph.D. Thesis) 1969 49 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 70-6362

In order to reconcile theory with experiment for high energy np charge exchange scattering, various conspiracy models are discussed. In a simple Regge pole model, the pion residue vanishes to t=o. The idea of conspiracy has given rise to a type of mechanism through which the pion contribution instead of vanishing at t=o, can cause a sharp peak in the differential cross section provided one assumes the existence of a P = (even)(+) trajectory, the other member of an M=1 parity doublet. Another mechanism is considered for which the usual pion residue vanishes at t=o. This is M=o pole for the pion quantum numbers. In addition, there exists an M=1 parity doublet with nonvanishing residues at t=o, one of which interferes with the pion to give rise to the sharp peak in the np charge exchange cross section. Dissert. Abstr.

N71-21831 Washington State Univ., Pullman.
INTRINSIC CARRIER CONCENTRATION AND MASS AND DOMINANT SCATTERING MECHANISM OF HEAVY HOLES IN INDIUM ANTIMONIDE
Robert William Cunningham (Ph.D. Thesis) 1969 153 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 70-5655

The heavy hole band structure proposed by Kane was used to derive a theoretical expression for the heavy hole density of states mass. This theory was used to estimate the mass from the value of n sub i determined experimentally. At low temperatures the mass was found to be 0.43 m sub 0. The mass was found to increase with increasing temperature. A fundamental quantum mechanical calculation of polar optical mode conductivity was carried out via the Kubo formulation. A field theoretic evaluation scheme was employed. When the theory was applied to the heavy hole mobility in InSb it was found that polar optical mode scattering was dominant. A combination of the polar optical mode conductivity and the temperature dependent density of states mass gave excellent agreement with the experimental data. Dissert. Abstr.

N71-21832 California Univ., Riverside.
RESONANCE STUDIES IN PION(+) PROTON INTERACTIONS BETWEEN 3 AND 4 GeV/c
Warren Carver Jackson (Ph.D. Thesis) 1969 103 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 70-6351

Three resonance studies are described from a high statistics bubble chamber experiment on pion(+) proton interactions at five incident momenta: 2.95, 3.19, 3.53, 3.74, and 4.08 GeV/c. A total of 39000 events with four charged outgoing particles were measured, of which 7300, 9300, and 2100 could be unambiguously constrained to the reactions: (1) pion(+) proton yields pion(+) pion(+) pion(−) proton; (2) pion(+) proton yields pion(+) pion(+) pion(−) proton pion(0); and (3) pion(+) proton yields pion(+) pion(+) pion(+) pion(−) neutron. Dissert. Abstr.

N71-21844 Minnesota Univ., Minneapolis.
PION(−) DEUTERON INTERACTIONS AT 2.3 GeV/c
Alberto Benvenuti (Ph.D. Thesis) 1969 163 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 70-5548

The following reactions were studied: (1) negative pion deuteron yields negative pion negative pion proton proton sub s, (2) negative pion deuteron yields negative pion negative pion neutral pion proton proton sub s, and (3) negative pion deuteron yields negative pion negative pion positive pion neutron proton sub s. A strong isobar production at a mass of approximately 1679 MeV/ sq c is observed in reaction 1. The spin and isospin of the isobar are determined; its production mechanism is found to be consistent with baryon exchange. The existence of isospin two boson resonances is investigated, but no evidence for the production of such resonances in the negative pion negative pion and negative pion negative rho meson systems is found. Reaction 3 is found to be dominated by the production of the negative delta hyperon neutral rho meson and negative delta hyperon negative pion positive pion final states. A study of the neutron negative pion negative pion system gives evidence for the production of an isospin 5/2 resonance with mass of 1645 MeV/c. The statistical significance of the observed effect is estimated to be five-standard deviations. Dissert. Abstr.

N71-21845 Florida State Univ., Tallahassee.
THE BETA DECAY OF TITANIUM 42
Ann Marshall Aldridge (Ph.D. Thesis) 1969 86 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 70-6285

The reaction Ca-40 (He-3, n) Ti-42 was used to investigate the positron decay of Ti-42 to Sc-42. Decays to both the 0(+) ground state of Sc-44 and to the 1(+) level at 615 kev were observed. The half life of Ti-42 was measured by three methods: by observing its positron activity as a function of time, by observing the 615keV gamma ray activity following the positron decay to the 1(+) level in Sc-42 as a function of time, and by observing the decrease in intensity of the 615 keV gamma peak at eight successive time intervals. Dissert. Abstr.

N71-21849 Ohio State Univ., Columbus.
MACROSCOPIC OSCILLATORY BEHAVIOR AND THE MOMENTUM DISTRIBUTION FUNCTION OF A NORMAL FERMION SYSTEM
Bernard Steginsky (Ph.D. Thesis) 1969 106 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 70-6888

The periodic, discontinuous behavior exhibited by an interacting many-fermion system at zero temperature is investigated. An expression for the leading discontinuous part of the particle density in a slab geometry is derived by means of a variational technique. The derivation is then extended to include other system properties as well. The variational technique, which is based on the Green's function method of quantum field theory, makes it possible to express the leading discontinuous part of any functional of the single-particle propagator in terms of a sum over functions associated with the infinite system. An expression for the leading discontinuous part of the particle density is derived for the case of interacting fermions in a magnetic field. Dissert. Abstr.

N71-21850 Vanderbilt Univ., Nashville, Tenn.
LEVELS IN THE DEFORMED EVEN-EVEN NUCLEI Gd 156 AND Dy 160
David Jon McMillan (Ph.D. Thesis) 1969 136 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 70-5408

The nuclear level structure of two even-even nuclei which lie in the mass region of permanently deformed nuclei, 150 less than or equal to A less than or equal to 190, was examined to evaluate current nuclear models of nuclei in this mass region. The experimental investigations of the radioactive decay of the nucleus Tb-156 to levels of the even-even nucleus Gd-156 include gamma-ray energy and relative intensity measurements, gamma-gamma coincidence measurements, and internal-conversion electron studies. A high-resolution Ge(Li) spectrometer was used to measure the Tb-156 photon energies in favorable cases to within 0.1 keV, and photon intensities of the stronger transitions with an accuracy of three to five percent. In addition, many low-intensity gamma rays previously unobserved were identified with the Tb-156 decay. The results of the present investigations indicate that the Bohr-Mottelson model of the nucleus including first-order band mixing may not be adequate to describe the decay characteristics of levels of the beta- and gamma-vibrational bands in Gd-156 and of the gamma-vibrational band in Dy-160. Dissert. Abstr.

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N71-20610# Technical Univ. of Denmark, Lyngby. Ionosphere Lab.
CHARGED PARTICLE EMISSION FROM A GEOSTATIONARY SATELLITE
Peter Stauning Nov. 1969 29 p refs Presented at the Colloq. on the ESRO Geostationary Magnetospheric Satellite, Lyngby, Den., 15 – 17 Oct. 1969
(IONLAB-P-26) Avail: NTIS

A quantitative model is derived for the interaction of a charged particle emitting satellite with an ionized medium characterized by: satellite radius, Debye distance, and electron gyro radius. In a numerical evaluation of the I-V characteristic for an idealized representation of a geostationary satellite, realistic values for the outer magnetosphere plasma densities, temperature, and magnetic fields have been used. It is shown that the emission of rather small currents of energetic particles can cause considerable changes in the satellite equilibrium potential. Changes of several hundred volts are found for electron or ion currents of about 1 milli ampere. It is suggested that such a capability should be included in the payload of the ESRO geostationary satellite to optimize the operational conditions for plasma and electric field experiments and, together with these experiments, to investigate plasma parameters, resonances, and instabilities and to study the precise interaction of a spacecraft with a dilute, ionized medium. Author (ESRO)

N71-20669# Miami Univ., Coral Gables, Fla. Dept. of Physics.
HELIOS PROGRAM Progress Report
Harry S. Robertson 15 Sep. 1970 56 p refs Sponsored by AEC
(ORO-3895-15) Avail: NTIS

Helios is an experimental facility in which electrons and lithium ions are heated by electromagnetic broad-band noise covering a spectral range around the electron and ion cyclotron frequencies. Sections are given concerning the following: (1) description of Helios, (2) optical diagnostics, (3) kinetic theory, statistical mechanics, and continuum thermodynamics of plasmas, (4) cesium plasma: basic data, and (5) wave studies and instability analysis of cesium magnetoplasmas. NSA

N71-20670# California Univ., Livermore. Lawrence Radiation Lab.
NONPHYSICAL MODIFICATIONS TO OSCILLATIONS, FLUCTUATIONS, AND COLLISIONS DUE TO SPACE TIME DIFFERENCING
A. Bruce Langdon 2 Nov. 1970 34 p refs Presented at 4th Conf. on Numerical Simulation of Plasmas, Washington, D.C., 2 – 3 Nov. 1970
(Contract AT-(04-3)-34)
(UCRL-72635; CONF-701113-2) Avail: NTIS

Oscillations, fluctuations, and collisions are examined in the idealized case of uniform and infinite or periodic plasma. Even in this simple situation there are several instances in which the models fail (mildly to grossly) to reproduce plasma behavior. The theory is outlined and such nonphysical behavior caused by the finite-difference methods is discussed. The plasma interacts coherently with the periodicity of the spatial grid on which the electromagnetic fields are defined and with the periodicity of the finite-difference time integration. Various parametric instabilities are sometimes induced, which may be either weak or strong and may be difficult to distinguish from real instabilities. There is also high-frequency noise associated with the rate at which particles cross the spatial grid cells. If the time step is large enough that the frequency of this noise exceeds the time-sampling frequency, then this noise degrades normal fluctuations and collisions and can become excessive. Author (NSA)

N71-20671# California Univ., Livermore. Lawrence Radiation Lab.
FORMULATION OF SELF CONSISTENT 2 AND 2 1/2 DIMENSIONAL ELECTROMAGNETIC AND RELATIVISTIC SIMULATIONS
Kurt H. Sinz 15 Oct. 1970 16 p refs Presented at 4th Conf. on Numerical Simulation of Plasmas, Washington, D.C., 2 – 3 Nov. 1970 Sponsored by AEC
(UCRL-72613; CONF-701113-3) Avail: NTIS

A formulation for self-consistent 2- and 2 1/2-dimensional electromagnetic and relativistic particle simulations is presented. The particles are infinitely long charged rods that move under the influence of their self-consistent fields. The numerical algorithms that numerically solve the appropriate Maxwell's equations and the Lorentz-force law in a first-order central difference scheme are given. The principal results are also applicable to simulations in one or three dimensions. Author (NSA)

N71-20872# California Univ., Livermore. Lawrence Radiation Lab.
NOISE SUPPRESSION TECHNIQUES IN MACROPARTICLE MODELS OF COLLISIONLESS PLASMAS
J. A. Byers 2 Nov. 1970 20 p refs Presented at 4th Conf. on Numerical Simulation of Plasmas, Washington, D.C., 2 - 3 Nov. 1970 Sponsored by AEC
(UCRL-72604; CONF-701113-1) Avail: NTIS

Noise-reduction techniques are examined as applied to macroparticle computer models of collisionless plasmas. The quiet-start technique, particle weighting, and the usefulness of forcing the system to a linear one are discussed. Author (NSA)

N71-20875# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics and Fusion Research.
MICROWAVE DIAGNOSTICS OF A PLASMA SLAB
E. Tennfors Nov. 1970 32 p refs Sponsored in part by the Swed. Atomic Res. Council and the Bank of Swed. Tercentenary Fund
(Rept-70-36) Avail: NTIS

Measurement of the wave propagation properties of a plasma can be used to determine a number of plasma parameters. A microwave interferometric method is described, which combines transmission, reflection, and absorption measurements on a transient plasma slab. The amplitude and phase changes are interpreted in terms of electron density, electron temperature, slab thickness, and motion of the slab. The theoretical results are applied to experiments with a rotating plasma. Author (ESRO)

N71-20747* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SMALL PLASMA PROBE Patent
Albert F. Beck, inventor (to NASA) Issued 5 Dec. 1967 (Filed 1 Jul. 1965) 3 p Cl. 313-271
(NASA-Case-XLE-02578; US-Patent-3,356,885; US-Patent-Appl-SN-469012) Avail: US Patent Office CSCL 20I

A very small plasma probe in the form of a tungsten wire collector supported in a tubular shield by a hypodermic tubing liner is described. Both ends of the liner are symmetrically pinched onto the wire to center the collector in the shield. Official Gazette of the U.S. Patent Office

N71-20803# Wisconsin Univ., Madison.
CYCLOTRON WAVE PLASMA STUDIES Final Report
J. E. Scharer, J. B. Beyer, and Chingshie Horng 1 Dec. 1970 12 p
(Contract AT(11-1)-1789)
(COO-1789-1) Avail: NTIS

The diagnostic measurement of plasma density and collisional frequency in the presence of a magnetic field is studied. The gridded electrodes and 10 GHz microwave transmitting and receiving antennas were redesigned and the correlation of the theoretical model with the measurements was made. As an alternative, a 35 GHz Fabry-Perot cavity resonator system was constructed. The plasma was a cold collisional plasma in the presence of a magnetic field with an assumed relaxation collisional model. An electromagnetic wave was propagated along a uniform static magnetic field with a propagation phase constant and an attenuation constant. Author (NSA)

N71-20833# Stanford Univ., Calif. Inst. for Plasma Research.
COLLISIONLESS STABILITY OF AN INHOMOGENEOUS, CONFINED, PLANAR PLASMA Final Report
John Paul Holdren Jun. 1970 238 p refs
(Grant NSF GK-1887)
(SU-IPR-351) Avail: Issuing Activity

The linear stability of a one-dimensional, selfconsistently confined sheet of plasma is investigated in the collisionless limit. Aside from the linearity and no-collision assumptions, none of the traditional approximations are employed. The method consists of integrating the (relativistic) ion and electron Vlasov equations along their characteristics; the exact unperturbed particle orbits. Fourier analysis in the two uniform space directions, Laplace analysis in time, and combination with Maxwell's equations then leads to a vector integrodifferential equation with complex, singular, tensor kernel. With appropriate boundary conditions, this equation becomes an eigenvalue problem; stability information results from treating frequency as the eigenvalue and examining its imaginary part. The various analytical and numerical difficulties which previously prevented the general application of this method are overcome or ameliorated and therefore it can be termed tractable, but still computationally expensive. It provides new and exact information about old problems, and it permits rigorous investigation of modes and one-dimensional equilibrian outside the scope of previous, approximate analyses. Author

N71-20909# Royal Inst. of Tech., Stockholm (Sweden). Div. of Electron Physics.
MEASUREMENTS OF ELECTRON VELOCITY DISTRIBUTION FUNCTIONS IN FRONT OF AND BEHIND A PLASMA SHEATH
Dag Andersson Sep. 1970 50 p refs
(Rept-70-31) Avail: NTIS

The current limits of plasma sheaths have been studied by measurements of the velocity distribution. The sheath appears at a constriction of a discharge tube in the presence of a low pressure mercury discharge without applied magnetic field. Difficulties were encountered and only preliminary results are given. ESRO

N71-20918# Wisconsin Univ., Madison.
[PLASMA PHYSICS] Technical Progress Report
[1970] 24 p refs
(Contract AT(11-1)-1726)
(COO-1726-70) Avail: NTIS

Research areas described are the following: (1) octupole studies, (2) theory, (3) plasma transport toward hoops, (4) superconducting studies, (5) microwave diagnostics, (6) engineering feasibility studies, (7) filling studies, and (8) abstracts, talks, and publications. NSA

N71-21101*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE ENTRY PLASMA SHEATH AND ITS EFFECTS ON SPACE VEHICLE ELECTROMAGNETIC SYSTEMS, VOLUME 1
Washington 1970 614 p refs Presented at 4th Plasma Sheath Symp., Hampton, Va., 13 - 15 Oct. 1970
(NASA-SP-252) Avail: NTIS HC $9.00/MF $0.95 CSCL 20I

Papers are presented on flight and laboratory measurements, plasma sheath diagnostics and effects on antennas, and added alleviants for improved reentry communication. For individual titles, see N71-21102 to N71-21131.

N71-21104# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
COMPARISON BETWEEN PREDICTED AND MEASURED BLACKOUT BOUNDARIES FOR EARTH ENTRY OF APOLLO
Michael G. Dunn *In* NASA. Langley Res. The Entry Plasma Sheath and Its Effects on Space Vehicle Electromagnetic Systems, Vol. 1 1970 p 33 - 45 refs (See N71-21101 10-25)
(Contract NAS5-9978)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20I

A semiempirical technique was developed to calculate the nonequilibrium flow electron density and collision frequency

distributions in the plasma surrounding an Apollo vehicle during earth atmosphere entry. Utilizing the results of these calculations, the communication blackout boundaries were constructed for a carrier frequency of 2.287 GHz for an entry velocity range of 14,000 to 35,000 ft/sec. For an arbitrary entry velocity in this range, the altitude uncertainty band is + or - 5000 ft. The predicted boundaries are compared to in-flight data gathered for Apollo 4, 6, 7, 8, and 10. The agreement between the predicted and measured blackout boundaries is reasonably good. Author

N71-21106*# Sperry Rand Research Center, Sudbury, Mass.
THE USE OF ELECTROACOUSTIC RESONANCES TO DETERMINE ELECTRON DENSITY PROFILES
A. W. Baird, III, and C. D. Lustig *In* NASA. Langley Res. Center The Entry Plasma Sheath and Its Effects on Space Vehicle Electromagnetic Systems, Vol. 1 1970 p 57-64 refs (See N71-20101 10-25)
(Contract F19628-70-C-0092)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20I

A technique is described for deducing an unknown electron density profile from observed electroacoustic resonance frequencies, which uses a simple resonance condition derived from the WKB approximation. The density profile is approximated by a step model, piecewise-linear model, modified piecewise-linear model, and polynomial model in both active and afterglow plasmas. Good agreement is obtained between the profile determined by this technique and one obtained theoretically. The method is applicable to the determination of reentry electron density profiles where at least the first- and second-order resonances can be observed. Author

N71-21107*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
REENTRY PLASMA MEASUREMENTS USING A FOUR FREQUENCY REFLECTOMETER
William L. Grantham *In its* The Entry Plasma Sheath and Its Effects on Space Vehicle Electromagnetic Systems, Vol. 1 1970 p 65-107 refs (See N71-21101 10-25)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20I

The results of a reentry plasma diagnostic experiment made at 25,000 ft/sec are presented for comparison with theoretical flow field values. Flow field plasma properties were inferred by use of a four-frequency microwave reflectometer having an electron density measurement range from approximately 10 to the 10th power to 10 to the 13th power electrons/cu cm. The reflectometer technique uses the sharp rise of reflection coefficient to indicate when the plasma approaches critical density. Good correlation exists between the reflectometer-determined plasma values and those derived from electrostatic probes in the aft flow field. Author

N71-21108*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ELECTROSTATIC PROBE MEASUREMENTS OF PLASMA SURROUNDING THREE 25,000 FOOT PER SECOND REENTRY FLIGHT EXPERIMENTS
W. Linwood Jones, Jr. and Aubrey E. Cross *In its* The Entry Plasma Sheath and Its Effects on Space Vehicle Electromagnetic Systems, Vol. 1 1970 p 109-136 refs (See N71-21101 10-25)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20I

A high altitude electrostatic probe experiment is described and data are presented for three RAM C reentries. The electron density profiles inferred from the probe measurements are compared with theoretical calculations, and the probable cause of significant disagreement is briefly discussed. Probe measurements during material-addition sequences for radio-blackout alleviation are presented, and comparisons of probe measurements with other pertinent diagnostic measurements are made. Author

N71-21113*# Sandia Corp., Albuquerque, N.Mex.
PREDICTION OF ELECTRON DENSITY IN THE BOUNDARY LAYER ON ENTRY VEHICLES WITH ABLATION
F. G. Blottner *In* NASA. Langley Res. Center The Entry Plasma Sheath and Its Effects on Space Vehicle Electromagnetic Systems, Vol. 1 1970 p 219-240 refs Sponsored in part by AEC (See N71-21101 10-25)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20I

A rather general computer code was developed for the numerical solution of the laminar boundary layer and thin shock layer (stagnation point only) equations for a multicomponent gas mixture with finite reaction rates. The capabilities of this computer program are indicated by presenting solutions for pure air flows and flows with carbon ablation. At the body surface the effects of oxidation and sublimation of carbon are taken into account with the following species included in the gas model: O2, N2, O, N, NO, NO(+), C1, C2, C3, CN, CO, and CO2. Results for the boundary layer along a 10 deg half-angle hyperboloid with ablation of carbon are compared to pure air results. Shock layer results for several wall temperatures and altitudes are presented and compared to pure air results. Other types of problems that can be solved with this computer code are indicated. Author

N71-21115*# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
LABORATORY MEASUREMENTS OF ELECTRON DENSITY AND ELECTRON TEMPERATURE WITH RAM FLIGHT PROBES
Michael G. Dunn *In* NASA. Langley Res. Center the Entry Plasma Sheath and Its Effects on Space Vehicle Electromagnetic Systems, Vol. 1 1970 p 261-276 refs (See N71-21101 10-25)
(Contract NAS1-9627)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20I

Two types of RAM flight probes (constant bias-voltage wires located perpendicular to the flow direction and swept-voltage wires aligned with the flow direction) were used to measure electron density and temperature in the expanding flow of a short-duration reflected-shock tunnel. Experiments were performed in the inviscid flow with both probes and in the nozzle-wall boundary layer with the constant bias-voltage probe. The electron density in these flows was inferred from the collected ion current and was independently measured using thin wire Langmuir probes operating in the free molecular flow regime. Microwave interferometers were used immediately upstream of the probe locations in order to measure the averaged free stream electron density. The test gas used in these experiments was nitrogen at an equilibrium reservoir condition of 7200 K and 17.1 atm. The agreement between the electron-density distributions obtained with these two probing techniques was found to be good. Author

N71-21116*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPARISON OF THEORETICAL AND EXPERIMENTAL ELECTRON DENSITY FOR RAM SC FLIGHTS
Charles J. Schexnayder, Jr., John S. Evans, and Paul W. Huber *In its* The Entry Plasma Sheath and Its Effects on Space Vehicles Electromagnetic Systems, Vol. 1 1970 p 277-303 refs (See N71-21101 10-25)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20I

Plasma diagnostic data from onboard Langmuir probes, reflectometers, and antenna VSWR, along with passive data from attenuation of beacon and telemetry signals, were obtained from RAM C reentries at orbital velocity. These data are compared with calculated flow field ionization and RF signal attenuation along streamlines for both inviscid flow and for inviscid flow merged with a boundary layer. Calculations were made for pure air using nonequilibrium chemistry throughout the flow field and for the same flow field with alkali contamination (in local ionic equilibrium) in the boundary layer. The results show that ambipolar electron-ion

diffusion has a large effect on peak concentration and distribution of electrons at high altitudes and that ionization of ablation impurities increases electron concentration in the boundary layer at medium and low altitudes. Author

N71-21117*# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
REENTRY PRECURSOR PLASMA: DETERMINATION OF THE VACUUM ULTRAVIOLET PHOTOIONIZING RADIATION FLUX
Paul V. Marrone and Walter H. Wurster *In* NASA. Langley Res. Center The Entry Plasma Sheath and Its Effects on Space Vehicle Electromagnetic Systems, Vol. 1 1970 p 305-334 refs (See N71-21101 10-25)
(Contract DAHC60-69-C-0130)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20I

A shock tube research program is described which provides data applicable to VUV radiation from blunt reentry vehicles. The radiation is considered from states in N2 sufficiently energetic to photoionize ambient O2 (E > 12 eV, wavelength < 1030 A). N2 absorption coefficients are obtained with a windowless spectrometer using reflected shock radiation to measure absorption in incident-shock heated gases. Additionally, nonequilibrium shock radiation profiles are measured to permit formulation of electronic excitation models and evaluation of rates. Experimental methods, the data and their use in reentry flow field calculations are discussed. Numerical results for precursor plasma properties and radar cross section effects are briefly presented. Author

N71-21118*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FURTHER STUDIES OF PRECURSOR ELECTRON DENSITIES AHEAD OF SHOCK WAVES
Masayuki Omura and Leroy L. Presley *In its* The Entry Plasma Sheath and Its Effects on Space Vehicle Electromagnetic Systems, Vol. 1 1970 p 335-350 refs (See N71-21101 10-25)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20I

Recent results are presented on precursor electron formation ahead of strong shock waves traveling into mixtures of nitrogen and oxygen in a shock tube. Efforts were made to develop a theoretical model of the ionization process that would provide a satisfactory prediction of the experimental data. It was found that a qualitatively correct prediction of electron density ahead of a shock wave can be given only by a spectrally detailed model of the photoionization and total absorption coefficients. Experimentally, Langmuir probes were used to study radial electron density profiles in a shock tube. Good quantitative agreement with the electron densities measured with a microwave interferometer was obtained with the Langmuir probes by assuming the electron temperature to be 500 K. Author

N71-21128*# Avco Corp., Wilmington, Mass.
SURVEY OF THE RANT PLASMA AND BREAKDOWN MODELS
R. L. Fante, J. T. Mahan, and R. O'Keefe *In* NASA. Langley Res. Center The Entry Plasma Sheath and Its Effects on Space Vheicle Electromagnetic Systems, Vol. 1 1970 p 479-488 refs (See N71-21101 10-25)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20I

Theoretical models are described which predict the effect of a reentry environment on the operation of an antenna system. The principal effects of the reentry plasma are (1) an alteration of the antenna radiation pattern, admittance, and attenuation, as well as a change in the isolation for the case of an array of antennas; (2) a change in the breakdown characteristics of high power antennas. Author

N71-21129*# Avco Corp., Wilmington, Mass. Systems Div.
A SHOCK TUBE STUDY OF PLASMA ALLEVIATION BY OXIDE DUST
A. Modica, G. Stepakoff, and H. Rosenbaum *In* NASA. Langley Res. Center The Entry Plasma Sheath and Its Effect on Space Vehicle Electromagnetic Systems, Vol. 1 1970 p 532-558 refs (See N71-21101 10-25)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20I

Plasma alleviation was observed in shock heated tungsten oxide-air suspensions at temperatures near 3200 K and one atm total pressure. Electron density histories wer e followed with X-band microwaves and oxide particle concentrations were measured by light scattering. For 3 micron size WO3 particles at concentrations of 36,000 particles/cu cm (0.03 weight fraction) electron densities were reduced by a factor of 2 below that of clean-air plasmas. The results are interpreted by an electron attachment mechanism including thermionic emission, air ionization, electron-particle attachment, three-body surface ion recombination, oxide gas-phase attachment, and catalytic surface attachment. A nonequilibrium stream tube program is used to compare calculated electron densities with experiment. Author

N71-21130*# Avco-Everett Research Lab., Everett, Mass.
AEROPHYSICAL PLASMA ALLEVIATION
E. M. Parmentier, K. L. Wray, and R. F. Weiss *In* NASA. Langley Res. Center The Entry Plasma Sheath and Its Effects on Space Vehicle Electromagnetic Systems, Vol. 1 1970 p 579-616 refs (See N71-21101 10-25)
(Contract F04701-70-C-0128)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20I

Two techniques for alleviating the reentry plasma sheath on a slender vehicle are analyzed. The objective of both techniques is to reduce the boundary layer electron density in the field of view of an antenna. The chemical technique considers the effects of the addition of small amounts of SF6 to the boundary layer. The objective is to keep the electrons attached as F(-) for a time long enough to accomplish alleviation. Results indicate that if electron attachment rates are sufficiently fast at the high temperatures in the boundary layer, a factor of 10 decrease in electron concentration is possible at high altitudes. Furthermore, results indicate that the concentrations of SF6 required for alleviation at low altitudes (and probably high altitudes) would certainly be sufficient to blow off the boundary layer. This suggests that an entirely aerodynamic solution might be possible in which a plume of electron-free gas is injected into the vehicle shock layer to divert the boundary layer around an antenna windown. For a hydrazine gas source, a mass flow of approximately 200 gm/sec at 100 kft can provide at least a factor of 5 reduction of integrated electron density. Author

N71-21131*# Space Sciences, Inc., Waltham, Mass.
THE REMOVAL OF FREE ELECTRONS IN A THERMAL PLASMA BY MEANS OF RAPIDLY EVAPORATING LIQUID ADDITIVES
Sol Aisenberg and Pung Nien Hu *In* NASA. Langley Res. Center The Entry Plasma Sheath and Its Effects on Space Vehicle Electromagnetic Systems, Vol. 1 1970 p 617-622 (See N71-21101 10-25)
(Contract F19628-68-C-0127)
Avail: NTIS HC $9.00/MF $0.95 CSCL 20I

Various mechanisms whereby different additives and additive processes increase the microwave transmission through the plasma sheath are studied. A comparison is made of the role of the relative effectiveness of various gaseous and liquid additives in reducing the free electron concentration and in enhancing the microwave transmission through the plasma sheath. Based upon an interpretation of the results obtained so far, a number of techniques are postulated as being important for increasing the effectiveness of chemical additives for use in the plasma sheath. In particular, it is found that additives when introduced into the plasma in the form of rapidly evaporating droplets (and of liquids with low boiling points) appear to be much more effective in increasing the microwave

transmission than additives introduced in the vapor form or introduced in a slowly vaporizing liquid droplet form. As a result of this observation, it is postulated that the vaporization itself of the additive can be an extremely important process in the plasma sheath modification. Author

N71-21227# Sandia Corp., Albuquerque, N.Mex. Technical Translation Service.
MEASUREMENT OF THE ION TEMPERATURE IN A HYDROGEN ARC BY MEANS OF THE THERMAL DOPPLER EFFECT
D. Ludwig and J. Raeder 3 Aug. 1970 26 p refs Transl. into ENGLISH from Z. Naturforsch. (West Germany), v. 25a, Apr. 1970 p 473–481 Sponsored by AEC
(SC-T-71-3001) Avail: NTIS

The determination of ion temperatures from the half-width of Doppler-broadened spectral lines (using side-on observation) was found to be possible, within reasonable error bounds, in plasma columns whose rotational velocity is sufficiently small that the Doppler broadening from that effect is negligible compared to the thermal Doppler effect. If the rotational velocity is large, the radial velocity distribution must be known in order that the macroscopic and thermal Doppler effects can be clearly separated. The result of the Abel inversion for the axis region with side-on observation depends ultimately on the shape of the radial emission coefficient of the spectral line used for the measurement. The error in the inversion will be small if this emission coefficient has its maximum on the arc axis. Author (NSA)

N71-21377# Los Alamos Scientific Lab., N.Mex.
INVESTIGATION OF FINE STRUCTURE OF A PLASMA FOCUS USING THE METHOD OF A MULTIPERFORATED PINHOLE CAMERA
V. I. Agafonov et al Dec. 1970 9 p refs Transl. into ENGLISH from Russian report IAE-2015 Sponsored by AEC
(LA-tr-70-25) Avail: NTIS

A method using X-ray pinhole cameras for investigating the final stage of cumulation of a shell with a noncylindrical constriction of the Z pinch is discussed. The use of a set of apertures from 4 to 44 microns and photographing from two mutually perpendicular directions permitted refining the diameter of the plasma focus, finding the complex fine structure, and comparing the experimental values of the plasma focus dimensions with the calculated ones. From the experimental results obtained, an estimate of the charged particle density in the plasma focus, $n = or > 1.5 1x 10$ to the 20th power/cu cm, was made. Author (NSA)

N71-21395 Northwestern Univ., Evanston, Ill.
ENERGY TRANSFER MECHANISMS IN A PLASMA
Carl Sanfrid Helrich, Jr. (Ph.D. Thesis) 1969 67 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 70-6476

A derivation from first principles of the methods of description of energy flow in a plasma is conducted illuminating the various forms of the energy and the mechanisms by which these forms are exchanged. A collection of point charged particles obeying Newton's laws of motion and the Maxwell equations is initially considered. From this level by taking ensemble averages and introducing various constructions for physical quantities, the Boltzmann and hydrodynamical levels are attained. Finally, macroscopic and fluctuating, or internal, waves passing through the plasma are considered. In each case an equation of transfer including both field and particle energies is derived. Standard forms of the momentum and energy equations are obtained if collisions are assumed to be elastic. Dissert. Abstr.

N71-21614# Stanford Univ., Calif. Inst. for Plasma Research.
COMPUTER SIMULATION EXPERIMENTS ON ELECTROSTATIC-INERTIAL CONFINEMENT Final Report
Christopher W. Barnes Sep. 1970 15 p refs
(Contract F44620-69-C-0007)
(AD-716860; SU-IPR-391; AFOSR-70-2432TR) Avail: NTIS CSCL 20/9

The inertial confinement scheme is a proposed method of containing a hot, dense fusion plasma by purely electrostatic means, that is to say, without the use of externally applied rf fields or dc magnetic fields. The fusion gases are confined by the inertia of high energy beams of particles focused at the plasma from all sides. Although, as now conceived, the scheme involves the high energy injection of ions, it was originally thought of as a device i which electrons were injected with high energy. Author (GRA)

N71-21693* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SELF-REPEATING PLASMA GENERATOR HAVING COMMUNICATING ANNULAR AND LINEAR ARC DISCHARGE PASSAGES Patent
Alexander P. Sabol, inventor (to NASA) Issued 25 Jul. 1967 (Filed 24 Feb. 1966) 7 p Cl. 315-111
(NASA-Case-XLA-03103; US-Patent-3,333,152;
US-Patent-Appl-SN-531642) Avail: US Patent Office CSCL 20I

A self repeating plasma generator having an annular channel and a linear channel is reported. The linear channel is tangent to the annular channel and is in communication with the annular channel. Electric fields are created in both channels, a magnetic field is created in both channels perpendicular to the electric fields and to the longitudinal dimension of the linear channel, and a gas is pumped into the channels. When an arc is initiated in the annular channel, it is pulled along the channel until it reaches the linear channel where the arc divides into two arcs. One arc proceeds down the linear channel accelerating the gas in front of it, and the other arc proceeds around the annular channel. Hence, an arc will be initiated and then proceed down the linear channel and accelerate the gas in front of it each time the arc in the annular channel makes a revolution. Official Gazette of the U.S. Patent Office

N71-21694* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PLASMA DEVICE FEED SYSTEM Patent
Shigeo Nakanishi and Eugene V. Pawlik, inventors (to NASA) Issued 22 Aug. 1967 (Filed 8 Sep. 1965) 3 p Cl. 60-202
(NASA-Case-XLE-02902; US-Patent-3,336,748;
US-Patent-Appl-SN-485957) Avail: US Patent Office CSCL 20I

A feed system for a plasma thrustor in which the ionization chamber is electrically isolated from the propellant supply source is described. This isolation is achieved by utilizing an electrically nonconductive tubular member through which the propellant flows from the source to the ionization chamber.
Official Gazette of the U.S. Patent Office

N71-21772 Colorado Univ., Boulder.
PLASMA PREHEATING WITH A SLOW CAPACITOR DISCHARGE IN A LARGE INVERSE PINCH DEVICE
Edward Andrews Crawford (Ph.D. Thesis) 1969 98 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 70-5835

A method for preheating a hydrogen plasma has been used in the inverse pinch geometry. It has been found that, starting with an initial pressure of 50m Torr. H2 in a 35 cm discharge chamber and using an axial magnetic field, nearly full ionization is sustained by the ionizing current. This type of preheat discharge allows a substantial loss of particles from the main chamber volume. Under the above conditions only about 20% of the initial filling density remains in the main plasma volume after 190 microseconds of the preheat discharge. Dissert. Abstr.

N71-21780# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
SIMPLE WAVES IN COLLISIONLESS INTERPLANETARY PLASMA GOVERNED BY CHEN-GOLDBERGER-LOW
J. T. Sielawa and R. S. B. Ong Jul. 1970 294 p refs
(Grant AF-AFOSR-0825-67)
(AD-717186; AFOSR-70-2925TR; Rept-08581-2-T) Avail: NTIS CSCL 20/9

The nonlinear propagation and steepening of waves in a collision-free plasma described by the Chew-Goldberger-Low (CGL) equations are investigated. The steepening characteristics as a function of the angle which the wave vector makes with the magnetic field are completely determined. It is also shown how condensation waves steepen into shock waves. The significant difference between the steepening process of these waves in collision-free plasmas and collision dominated MHD is discussed. Author (GRA)

N71-21817 California Univ., Berkeley.
PAIR DISTRIBUTION FUNCTION FOR A CLASSICAL COULOMB GAS
Fernando del Rio (Ph.D. Thesis) 1969 119 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 70-6086

The pair distribution function for a classical one-component plasma is obtained by summing terms of the Montroll-Mayer cluster expansion of g(r) for the Coulomb potential. The diagrammatic method used to describe the perturbation expansion is essentially the nodal expansion of Abe in which chains of Coulomb interactions are summed to give new cluster integrals in which only the screened Coulomb potential appears. From the resulting nodal expansion a simple class of diagrams, those with chains and bubbles in series, is found to give the long distance limit of g(r) for values of the plasma coupling parameter into the intermediate coupling regime. This class of diagrams is summed and rigorous results for the asymptotic from of g(r) are obtained. Dissert. Abstr.

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N71-20611# Case Western Reserve Univ., Cleveland, Ohio. Div. of Metallurgy and Materials Science.
NON-BASAL SLIP IN ALUMINA AT HIGH TEMPERATURES AND PRESSURES
A. H. Heuer, R. F. Firestone, J. D. Snow, and J. Tullis Nov. 1970 14 p refs
(Contract N00014-67-A-0404-0003)
(AD-716788; TR-3) Avail: NTIS CSCL 20/12

A zero degree Czochralski sapphire has been deformed in tensile creep at 1600-1800C, and fine-grained alumina polycrystals have been deformed under hydrostatic confining pressures at 1000-1200C, in order to activate non-basal slip. Deformation in both cases is thought to have involved pyramidal slip ((-1)102 plane). Activation of this slip system, together with basal and prismatic plane slip, allows the von Mises criterion to be satisfied. In addition, water weakening was observed to occur in the deformation of polycrystalline alumina under hydrostatic confining pressures. Author (GRA)

N71-20628# Michigan Univ., Ann Arbor. Dept. of Chemistry.
LOW TEMPERATURE CHEMICAL THERMODYNAMICS PROJECT Technical Progress Report, Nov. 1969 – Nov. 1970
Edgar F. Westrum, Jr. 1 Nov. 1970 31 p refs
(Contract AT(11-1)-1149)
(COO-1149-180; TPR-18) Avail: NTIS

Studies on chemical thermodynamics and solid state behavior of matter over the low temperature region were continued. Studies on actinide compounds, lanthanide compounds, organic crystals, and selected inorganic compounds are briefly reported. NSA

N71-20733# Naval Research Lab., Washington, D.C.
COMPUTER PROGRAM FOR THE LEAST SQUARES DETERMINATION OF THE PHASES OF THE CRYSTAL STRUCTURE FACTORS Final Report
J. Harrison Hancock, Janet E. Fisher, and Herbert A. Hauptman 16 Dec. 1970 46 p refs
(AD-716747; NRL-7187) Avail: NTIS CSCL 20/2

An effective technique, employing the Principle of Least Squares, which leads from the values of the crystal structure invariants to the values of individual phases, has recently been obtained. In the present report the details of the computer program which implements this technique are described. An auxiliary program to identify the required structure invariants has also been written and is contained herein. Author (GRA)

N71-20744# Royal Inst. of Tech., Stockholm (Sweden). Dept. for Microwaves.
LSA RELAXATION OSCILLATIONS IN A WAVEGUIDE IRIS CIRCUIT
B. Jeppsson and P. Jeppesen (Tech. Univ. of Den.) [1970] 33 p refs
Avail: NTIS

Large signal computer simulation of gallium arsenide limited space charge accumulation (LSA) relaxation oscillations in an X-band waveguide iris circuit are presented. The study is focused on a particular oscillator and a realistic model of an experimental circuit is used. However, the results are typical for other LSA relaxation oscillators. Basic features of the microwave circuit, characteristic voltage and current waveshapes, frequency tuning with bias voltage and oscillator starting transients are discussed. The RF output power is shown to build up in less than ten cycles. Circuit optimization for high dc to RF conversion efficiency is discussed and circuit data for nearly 30 efficiency are given. Finally, efficiency degradation is discussed when doping gradients are present, and efficiencies of 15% and 10% appear possible for doping gradients as high as 20% and 60% respectively. Hence, the LSA relaxation mode is shown to be less sensitive to doping gradients than the sinusoidal LSA mode. Author (ESRO)

N71-20745# Royal Inst. of Tech., Stockholm (Sweden). Microwave Dept.
LSA RELAXATION OSCILLATOR PRINCIPLES
P. Jeppesen (Tech. Univ. of Den.) and B. Jeppsson [1970] 38 p refs
Avail: NTIS

Oversized n-GaAs diodes operating with the limited space charge accumulation (LSA) mode with doping to frequency ratios in the 1 – 5 x 100,000 . s/cu cm range are investigated in circuits that contain a short-circuited high impedance transmission line foreshortened to resonate the electronic parallel capacitance of the diode. By comparing computer simulations with experiments, such diodes are shown to operate in a non-sinusoidal LSA relaxation mode which offers good efficiency, effective space charge control and a fast build-up of the oscillations; details of the computer

program are also given. A simple analysis is developed which defines the inductive and capacitive time constants controlling the voltage waveshape and explains the frequency tuning with bias voltage and the effective space charge control. The analysis is shown to be suitable for oscillator design purposes. Author (ESRO)

N71-20746# Oxford Univ. (England). Engineering Lab.
MICROWAVE INVESTIGATION OF SEMICONDUCTING MATERIAL
P. A. Bostock Oct. 1970 157 p refs Sponsored by Sci. Res. Council
(Rept-1122/70) Avail: NTIS

Microwave solid-state power sources are reviewed, particular attention being paid to those in which the active semiconductor has a region of negative differential mobility beyond a certain threshold field. Some of the origins of this behaviour, together with the various modes of operation of devices made from such material, are considered. Theoretical derivations and empirical determinations of the velocity-field characteristic of gallium arsenide, are described, and experiments of the interaction of high power microwaves with a semiconductor sample are compared with alternative techniques. The experiments were carried out using a microwave bridge circuit and the quantity primarily measured was the attenuation produced by a rod shaped germanium sample. The relationship between attenuation and conductivity was established empirically, and the velocity-field characteristic was derived from the dependence of the mean conductivity on the peak microwave electric field at the sample. Microwave propagation in a slab loaded waveguide was examined and applied to the determination of semiconductor properties discussed. The temperature variation of the velocity-field characteristic of gallium arsenide was then used to estimate the temperature dependence of device efficiency as a function of bias field. There was found to be a substantial increase in efficiency at low temperatures. Suggestions for further work including the determination of the velocity field characteristic of indium phosphide are made. Author (ESRO)

N71-20763# Signals Research and Development Establishment, Christchurch (England).
THE VARIATION OF FREQUENCY WITH TEMPERATURE OF A TUNABLE COAXIAL CAVITY GUNN DIODE OSCILLATOR
P. J. Soilleux Sep. 1970 25 p refs
(SRDE-70042) Avail: NTIS

A semi-theoretical analysis has been carried out to determine the relative importance of factors contributing to the variation of frequency with temperature of a tunable coaxial cavity Gunn diode oscillator. No attempt has been made to analyze the individual effects of the solid state parameters of the gallium arsenide Gunn diode itself. A method of automatically compensating the negative variations of frequency with temperature of both the Gunn diode and its package and the coaxial resonant cavity has been devised. Experiments emphasize the need for producing Gunn diodes having reproducibly constant variation of frequency with temperature. Author (ESRO)

N71-20772# Naval Ordnance Lab., White Oak, Md.
BAND INVERSION AND THE ELECTRICAL PROPERTIES OF LEAD-TIN-SELENIDE SEMICONDUCTING ALLOYS Final Report
Gerald F. Hoff and Jack R. Dixon 15 Nov. 1970 127 p refs
(AD-716869; NOLTR-70-218) Avail: NTIS CSCL 20/12

The influence of valence-conduction band inversion upon the electrical properties of the Pb(1-x)Sn(x)Se semiconducting alloys was investigated. It is shown theoretically that the band inversion phenomenon first proposed by Dimmock, Melngailis, and Strauss should affect the electrical properties of these alloys. A preliminary but major part of the research dealt with the controlled preparation and characterization of the Pb(1-x)Sn(x)Se alloys in both film and bulk crystalline forms. The apparatus and methods developed and employed for these purposes are discussed in detail. In addition, the electrical, magnetic, and cryogenic equipment used in the measurement of the electrical resistivity and Hall coefficient are discussed. Author (GRA)

N71-20784# California Univ., Berkeley. Dept. of Electrical Engineering.
ON THE CALCULATION OF DOPING PROFILES FROM C(V) MEASUREMENTS ON TWO-SIDED JUNCTIONS
H. J. J. De Man (Louvain Univ.) 1970 12 p refs Sponsored by ESRO
Avail: NTIS

It is shown that for a two-sided junction, the doping profile can only be uniquely determined from C(V) measurements if the doping profile is known on one side. Expressions are derived which enable the calculation of the complete doping profile from C(V) measurements and the knowledge of the doping profile on one side. Author (ESRO)

N71-20828*# Rice Univ., Houston, Tex.
RESEARCH ON THE PHYSICS OF SOLID MATERIALS Semiannual Status Report, 1 Jul. – 31 Dec. 1969
F. R. Brotzen, H. E. Rorschach, and M. L. Rudee 31 Dec. 1969 43 p
(Grant NGR-44-006-001)
(NASA-CR-117401; SASR-21) Avail: NTIS CSCL 20L

Mechanical, electrical, and optical properties of solids are discussed as well as defect structure, magnetism and superconductivity, thermodynamics, solid surfaces, and thin magnetic films. J.M.

N71-20869# Joint Publications Research Service, Washington, D.C.
THEORY OF PROCESSES OF ZONE RECRYSTALLIZATION WITH ACTIVE FLUX
K. M. Rozin *In its* Physico-Chem. Principles of Crystallization Processes used in the Superpurif. of Metals 8 Mar. 1971 p 23–29 refs (See N71-20866 10-17)
Avail: NTIS

Simple zone recrystallization was analyzed from the viewpoint of the effectiveness of superrefinement. Certain ways to intensify refinement during zone recrystallization, including complex methods, are discussed. A plan of zone recrystallization using active flux is described and its characteristics are examined. The theory of the process of zone recrystallization with active flux is developed. The new complex process is compared with the elementary processes of simple zone recrystallization and extraction and the advantage of the new process in terms of refinement efficiency is explained. It is shown that the proposed theory contains, as a partial case, the law of distribution of impurity in a crystal in simple zone recrystallization, expressed by the Reed equation. Author

N71-20878# Joint Publications Research Service, Washington, D.C.
CALCULATION OF EFFECTIVE IMPURITY DISTRIBUTION RATIOS DURING GROWTH OF MONOCRYSTALS FROM MELT
K. M. Rozin et al *In its* Physico-Chem. Principles of Crystallization Processes used in the Superpurif. of Metals 8 Mar. 1971 p 98–108 refs (See N71-20866 10-17)
Avail: NTIS

The distribution of the impurities lead, copper, and zinc in KCl monocrystals grown from a melt by the Kiropulos method was investigated. The causes of discrepancy between experimental

data of the given mathematical model for processes of normal directed crystallization were analyzed. It is shown that when calculating impurity distribution it is necessary to take into account not the entire melt mass, but only that part of it which participates in exchange with the growing crystal. Based on these investigations equations are proposed to describe the processes of normal directed crystalization. Various methods were analyzed and a new procedure for determining the effective impurity distribution ratios is proposed. Author

N71-20884# Joint Publications Research Service, Washington, D.C.

X-RAY DIFFRACTION ANALYSIS OF FINE STRUCTURE OF MONOCRYSTALS PRODUCED BY ZONE RECRYSTALLIZATION

A. I. Yevstyukhin et al *In its* Physico-Chem. Principles of Crystallization Processes used in the Superpurif. of Metals 8 Mar. 1971 p 150 - 155 refs (See N71-20866 10-17)

Avail: NTIS

Fine structure X-ray diffraction analysis was performed on a monocrystal of niobium produced by the electron beam zone recrystallization method. The technique used a spectrograph with a flat vibrating crystal. The X-rays from a sharply focused source illuminated the crystal, which, in contrast to ordinary schemes, rotated discretely around its axis, which lay on the surface of the crystal. The diffraction pattern was recorded on a photographic plate placed perpendicular to the reflected rays. Discrete rotation was employed in order to avoid erosion of the diffraction pattern as a result of overlapping of reflections. X-ray topographs are presented of several specimens of niobium monocrystal cut on different planes and reflections. A.L.

N71-20885# Joint Publications Research Service, Washington, D.C.

DISLOCATION STRUCTURE OF REFRACTORY METALS OF GROUP 6a AS FUNCTION OF PRODUCTION METHOD

V. N. Bykov et al *in its* Physico-Chem. Principles of Crystallization Processes used in the Superpurif. of Metals 8 Mar. 1971 p 156 - 161 refs (See N71-20866 10-17)

Avail: NTIS

The dislocation structure of the metals of group VIB (chromium, molybdenum, tungsten), obtained from the gas phase and produced by the electron beam and zone melting methods, were analysed. The orientation of monocrystals in relation to the plane of the polished section and the degree of perfection were determined by X-ray methods and with the aid of photomicrographs. Selective etching was used for dislocation structure analysis. The degree of perfection and the dislocation structure of chromium, molybedenum, and tungsten depend considerably on the monocrystal production methods. Monocrystals obtained by zone melting with sample rotation were found to be the most perfect. A. L.

N71-20886# Joint Publications Research Service, Washington, D.C.

INVESTIGATION OF EFFECT OF AUTOMATIC CONTROL AND CRUCIBLE SHAPE ON ZONE RECRYSTALLIZATION PROCESS

V. V. Krapukhin et al *In its* Physico-Chem. Principles of Crystallization Processes used in the Superpurif. of Metals 8 Mar. 1971 p 161 - 166 refs (See N71-20866 10-17)

Avail: NTIS

For stabilization of the thermal mode of zone recrystallization with induction heating it was proposed to regulate the electrical power from the generator according to the temperature of an additional oven, heated by an inductor connected in series with the primary inductors of the apparatus. Automatic control by the proposed method increased the yield of refined germanium by 6.5% after zone recrystallization. Comparison of the efficiencies of zone recrystallization of germanium in crucibles of trapezoidal and semicylindrical shape showed the latter to have the advantage. In this case the refined germanium yield was about 3% greater and the ingot had a coarser crystalline structure. Property uniformity through the length of ingots of trapezoidal shape was better than in ingots of semicylindrical shape. Author

N71-20887# Joint Publications Research Service, Washington, D.C.

INFLUENCE OF HEATING METHODS ON EFFICIENCY OF DIRECTED CRYSTALLIZATION

V. N. Nefedov et al *In its* Physico-Chem. Principles of Crystallization Processes used in the Superapurif. of Metals 8 Mar. 1971 p 166 - 170 refs (See N71-20866 10-17)

Avail: NTIS

Investigations were carried out on a directed crystallization apparatus using induction heating. The apparatus was designed to permit directed crystallization in a vacuum, and also in a protective atmosphere of argon or hydrogen. Germanium with a specific resistivity from 5 to 20 ohm/cm was charged in graphite vessels of semicylindrical shape. After fusion, the inductor was moved at a rate of 4 mm/min. The process was conducted in an atmosphere of hydrogen. The specific electrical resistivity of the ingots obtained was measured. For comparison germanium was with a specific resistivity of 5-20 ohm/cm subjected to directed crystallization on an apparatus with resistance heaters. Specific resistivity distribution through the ingot after directed crystallization using induction heating and resistance heating is discussed. These experiments established that it is better to use induction heating for directed crystallization since this method provides for more even distribution of impurities throughout the ingots. A.L.

N71-20888# Joint Publications Research Service, Washington, D.C.

ON ONE FEATURE OF VERTICAL CRUCIBLE ZONE RECRYSTALLLIZATION

V. N. Vigdorovich et al *In its* Physico-Chem. Principles of Crystallization Processes used in the Superpurif. of Metals 8 Mar. 1971 p 170 - 174 refs (See N71-20866 10-17)

Avail: NTIS

Results are presented of an investigation of impurity distribution as a function of the direction of travel of the zone in vertical crucible zone recrystallization. The experiment was performed on tellurium, which loses 5-7% of its volume during crystallization. The containers were quartz ampules with an inside diameter 10 mm and a wall thickness of 1.0-1.5 mm. These ampules were not damaged during zone travel from top to bottom. Since the ampules sometimes break as the zone travels from bottom to top, impurity distribution was investigated only in those tests in which the ampules were not destroyed. Results indicated that the impurities were distributed through the length of the tellurium charge in nearly all cases according to established principles. As a rule, refining proceeded more effectively when the zone moved from bottom to top. A. L.

N71-20889# Joint Publications Research Service, Washington, D.C.

PRODUCTION OF HOMOGENEOUS ALLOYED MONOCRYSTALS

V. N. Vigdorovich et al *In its* Physico-Chem. Principles of Crystallization Processes used in the Superpurif. of Metals 8 Mar. 1971 p 174 - 179 refs (See N71-20866 10-17)

Avail: NTIS

A method was investigated for producing chemically homogeneous monocrystals of alloys, based on the eccentric pulling of several monocrystals from a melt, anisotropy and polarity of the

distribution ratio, and which takes into account its dependence on growth rate. In the experiment, some of the crystals were grown in the required crystallographic direction and at the required rate. The other single crystals were grown in the other crystallographic direction, for which the distribution ratio had the opposite value relative to unity. Calculations performed to determine the required pulling rate of auxiliary monocrystals for known growth parameters of the basic monocrystals are discussed, and the equations used for these calculations are described. A.L.

N71-20890# Joint Publications Research Service, Washington, D.C.

DIRECTED CRYSTALLIZATION OF COMPOUNDS DURING IMPURITY EXCHANGE OF THE MELT WITH THE ATMOSPHERE AND CRUCIBLE

V. N. Vigdorovich et al *In its* Physico-Chem. Principles of Crystallization Processes used in the Superpurif. of Metals 8 Mar. 1971 p 179–188 refs (See N71-20866 10-17)

Avail: NTIS

The three most common processes of directed crystallization, growth of crystals from a melt by the Bridgemen and Chokhralskiy methods and zone recrystallization, were investigated. The equations and assumptions used to investigate each of the methods are described and discussed. A.L.

N71-20919# Arizona Univ., Tucson. Dept. of Physics.

PERSISTENT CURRENTS IN THE EXCITONIC INSULATOR

W. R. Henson and R. H. Parmenter 21 Dec. 1970 28 p refs

(Contract N00014-67-A-0209-0007)

(AD-716749; TR-5) Avail: NTIS CSCL 20/12

The energy gap is solved for the excitonic insulator in the presence of persistent currents. In the zero temperature case, an analytical solution is found, while numerical solutions are found for finite temperatures. It is shown that the solutions vary only slightly as the hole-electron mass difference is varied. Critical currents, corresponding to a first-order transition back to the normal phase, are found numerically. Author (GRA)

N71-21011# Laboratoire d'Automatique et de ses Applications Spatiales, Toulouse (France).

PHYSICAL STUDY OF THE FAILURE OF MOS COMPONENTS: CASE OF LOW ENERGY IONIZING RADIATION Final Report [ETUDE PHYSIQUE DE LA DEFAILLANCE DES COMPOSANTS A STRUCTURE MOS: CAS DES RADIATIONS IONISANTES RAPPORT FINAL]

H. Martinot, D. Esteve, J. Buxo, and A. Martinez 30 Jul. 1969 57 p refs In FRENCH

(Contract CNES-302-67)

(Publ-592) Avail: NTIS

Effects of low energy ionizing radiation on metal oxide semiconductors are analyzed and it is found that X-rays and electrons do not have the same effect. The main degradation parameters involved are photoconduction in the volume of silicon and emission conditions of the electrodes. Annealing of irradiated semiconductors at temperatures up to 300 C is also discussed and it is found that these semiconductors have operation instabilities above 150 C. ESRO

N71-21026# Harvard Univ., Cambridge, Mass. Dept. of Chemistry.

X-RAY CRYSTALLOGRAPHIC METHODS IN ORGANIC CHEMISTRY: SINGLE CRYSTAL REACTIONS AND TRANSFORMATIONS RELEVANT TO SOLID-STATE CHEMISTRY AND SEMI-CONDUCTORS Final Technical Report, 1 Feb. 1966–31 Aug. 1970

J. Z. Gougoutas 31 Aug. 1970 29 p refs

(Grants AF-AFOSR-1059-66; AF-AFOSR-1060-66; AF-AFOSR-1509-68; AF-AFOSR-1769-69; AF-AFOSR-1769-69A)

(AD-717160; AFOSR-70-2920TR) Avail: NTIS CSCL 7/3

A summary is given of work which included the study and improvement of X-ray diffraction methods for the study of both ordered and disordered organic single crystals over a wide temperature range. A wide variety of single crystal reactions were discovered. The molecular motions within the single crystal matrix are often surprisingly large and in several instances indicate the surprising ability of substituted benzene rings to flip-flop in an ordered manner during the transformations. In general, such motions greatly effect the chemical and physical properties of the solids and no doubt influence the solid state properties of semi-conductors. Principles were developed for the prediction of crystal structures in which only highly specific molecular motions can occur. In this way, undesirable properties arising from such motions could be controlled. Moreover, the control of ordered motions in a solid could allow for the production of otherwise unavailable solid phases exhibiting unusual physical and chemical properties. Author (GRA)

N71-21067# Office of Naval Research, London (England).

BATTELLE GENEVE COLLOQUIUM ON CRITICAL PHENOMENA, 1970

M. A. Garstens 20 Nov. 1970 10 p refs Conf. held at Geneva and Gstaad, Switz., 7–12 Sep. 1970

(AD-716947; ONRL-C-29-70) Avail: NTIS CSCL 20/12

On 7-12 September 1970, the Battelle Institute sponsored a Colloquium on Critical Phenomena held in Geneva and Gstaad, Switzerland, in honor of Novel Laureate Lars Onsager. The Colloquium was concerned with assessing the contribution of current research in critical phenomena to the science of materials. It undertook to elucidate recent progress in the experimental and theoretical studies of critical phenomena in alloys, magnets, and superconductors; to examine the status of current description of critical phenomena and of the knowledge of transport phenomena in the critical regime; and to suggest fruitful directions for future work. (Author). GRA

N71-21073*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

IMAGE EFFECTS AND THE VIBRATING SAMPLE MAGNETOMETER

Donald R. Behrendt and Donald E. Hegland Washington Mar. 1971 9 p refs

(NASA-TN-D-6253; E-6016) Avail: NTIS CSCL 20L

Some anomalous effects observed in the output signal of the vibrating sample magnetometer are investigated. The variations in amplitude and phase of the signal coil voltage are attributed to changes in the magnetic images of the sample in the pole pieces of the electromagnet due to changes in the permeability of the pole pieces. A set of eight signal coil voltage on the output signal and which also reduced changes in amplitude of the output signal due to these image effects. Author

N71-21074*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SPIN ORBIT COUPLING AND ENERGY SHIFTS IN SINGLE CRYSTAL AND PYROLYTIC GRAPHITE

John A. Woollam Washington Mar. 1971 17 p refs

(NASA-TN-D-6252; E-6023) Avail: NTIS CSCL 20L

The first observation of spin split Landau levels both in natural single crystals and in highly ordered pressure annealed pyrolytic samples is discussed. Experimental splittings are compared with the theory of McClure and Yafet. Discrepancy between theory and experiment is partially accounted for by large shifts in the Fermi energy with magnetic field. Author

N71-21078*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PHASE TRANSITIONS AND MAGNETOSTRICTION IN CsMnCl3-2H2O
John A. Woollam and Paul R. Aron 1971 10 p refs Presented at Am. Phys. Soc. Meeting, Cleveland, 29 Mar.–2 Apr. 1971
(NASA-TM-X-52997) Avail: NTIS CSCL 20L

Dimensional changes (strain) along the three principle crystal axes are studied as a function of magnetic field and temperature in the antiferromagnetic, spin flopped, and paramagnetic phases. Changes in dimensions are examined through the phase transitions between the magnetic states. Author

N71-21141# Ecole Nationale Superieure de Mecanique, Nantes (France).
EQUATIONS FROM THE DIFFUSION PHENOMENON AND THE KIRKENDALL EFFECT [EQUATIONS PHENOMENOLOGIQUES DE LA DIFFUSION ET EFFET KIRKENDALL]
J. Pouliquen *In its* Ann. of Mech. Semiann. Rept., 1969 p 217–229 refs In FRENCH (See N71-21133 10-32)
Avail: NTIS

The solid diffusion of atoms in binary alloys with low concentration gradients is discussed applying the principle of irreversible processes. A mathematical model is derived which takes into account the possible existence of a temperature gradient but excludes diffusion under nonhydrostatic external pressure. The work is extended to the case of the Kirkendall effect. ESRO

N71-21451*# Chicago Univ., Ill. Dept. of Geophysical Sciences.
CATION DISTRIBUTION STUDIES IN CLINOPYROXENES, OLIVINES AND FELDSPARS USING MOESSBAUER SPECTROSCOPY OF Fe57 Final Technical Progress Report, Period Ending 31 Jan. 1971
Stefan S. Hafner 31 Jan. 1971 16 p refs Submitted for publication
(Contract NAS9-8080)
(NASA-CR-114941) Avail: NTIS CSCL 20L

Magnesium in clinophyroxenes with more than 20 percent wollastonite occurs almost exclusively at the M1 position. In calcium-poor pigeonites from rocks 12018, 12021, and 12053 Mg is significantly more disordered. An olivine from 12018 exhibits 20 percent ordering of iron in one of the M-positions. The Mg,Fe(2+) distribution in clinopyroxenes and olivines is interpreted in terms of equilibrium distribution temperatures estimated from heating experiments and subsolidus cooling history. Fe(2+) in feldspars occurs at calcium as well as aluminum positions. No Fe(3+) was detected in our mineral separates. Author

N71-21458*# Martin Marietta Corp., Denver, Colo.
SOLID STATE SEQUENCER SYSTEM, PHASE 2, VOLUME 2. APPENDIX A: ENGINEERING DRAWING LIST Summary Report
Mar. 1971 9 p
(Contract NAS9-9334)
(NASA-CR-114956; MCR-71-55-Vol-2) Avail: NTIS CSCL 20L

A numerical list and an itemized list of engineering drawings for the solid state sequencer system are presented. N.E.N.

N71-21460*# Martin Marietta Corp., Denver, Colo.
SOLID STATE SEQUENCER SYSTEM, PHASE 2, VOLUME 1 Summary Report
Mar. 1971 70 p
(Contract NAS9-9334)
(NASA-CR-114955; MCR-71-55-Vol-1) Avail: NTIS CSCL 20L

The solid state sequencer system is designed to control several independant sequences and consists of a master unit located in the command module and the jettison controller located in the service module. The logic circuitry, a combination of integrated circuits and core-transistor circuits, is described. The results of environmental analyses and acceptance tests are included, along with a list of parts. N.E.N.

N71-21461*# Martin Marietta Corp., Denver, Colo.
SOLID STATE SEQUENCER SYSTEM, PHASE 2 VOLUME 3. APPENDIX B: WIRING LISTS Summary Report
Mar. 1971 108 p
(Contract NAS9-9334)
(NASA-CR-114957; MCR-71-55-Vol-3) Avail: NTIS CSCL 20L

Wiring lists for the solid state sequencer system are presented alphabetically by signal name for each mother board and by pin number for the connectors. N.E.N.

N71-21701# Tata Inst. of Fundamental Research, Bombay (India).
LECTURES ON WEAK INTERACTIONS
F. E. Low 1970 103 p refs
Avail: NTIS

The characteristics of weak interactions of leptons are presented. Subjects discussed are: (1) molecular interactions, (2) estimation of unitarity cut-off, (3) Adler-Weisberger relation, (4) indefinite metric, (5) self-consistent approaches dealing with strong effects of weak interactions, and (6) mathematical relationships. Author

N71-21702# Washington Univ., St. Louis, Mo. Dept. of Physics.
SPIN-PHONON INTERACTIONS IN METALS AND ANTIFERROMAGNETIC INSULATORS Final Report, 1 Dec. 1967–30 Nov. 1970
Dan I. Bolef Jan. 1971 15 p refs
(Grants AF-AFOSR-1412-68; NSF GP-7931)
(AD-717190; AFOSR-70-2923TR) Avail: NTIS CSCL 20/12

The research performed in this laboratory is primarily concerned with the interaction of ultrasound with nuclear and electron spins in solids. The present report describes (1) the detailed studies made under the contract of the elastic, magneto-elastic, F19 nuclear acoustic resonance and Mn19 nuclear acoustic resonance in the cubic antiferromagnet, RbMnF3; and (2) the study, as a function of temperature, of the anomalies in the elastic properties and nuclear acoustic resonance in bcc metal crystals. GRA

N71-21703 Vanderbilt Univ., Nashville, Tenn.
A STUDY OF GRAIN BOUNDARIES BY FIELD ION MICROSCOPY
Robert John Bayuzick (Ph.D. Thesis) 1969 153 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 70-5384

Studies were made of grain boundaries in tungsten and thoriated tungsten utilizing field ion microscopy. Several high angle boundaries were observed and compared to the coincidence lattice model. Two high angle boundaries forming a node with a low angle boundary were not consistent with the theory; their misorientation relationships were far removed from all coincidence lattice descriptions. The other high angle boundaries observed involved misorientations about [110] and conformed to the model. However, the results are not entirely unambiguous in that all specimens exhibit a [110] fiber texture which predetermines the axis of misorientation to be observed. In addition, the very nature of the coincident lattice model, together with the accuracy of orientational measurement, does not allow a critical test for [110] rotations. Dissert. Abstr.

N71-21704# Brookhaven National Lab., Upton, N.Y.
INVESTIGATION OF THE HEISENBERG MODEL OF THE IMPURE FERROMAGNETS, PART 1
E. Provestski Nov. 1970 17 p refs Transl. into ENGLISH from Russian report Sponsored by AEC
(BNL-tr-389-Pt-1) Avail: NTIS

The Heisenberg model of the impure ferromagnets was investigated within the context of the real spin-wave theory. The magnetization at an arbitrary lattice point was determined in the Tyablikov's approximation, using the Green's function method; the elastic and transverse inelastic parts of the cross section for scattering of slow neutrons were also calculated. Author (NSA)

N71-21706 National Lending Library for Science and Technology, Boston Spa (England).
ON THE THERMODYNAMICS OF SOLID SOLUTION VAPOR PHASE EQUILIBRIA IN THE INDIUM ARSENIDE GALLIUM ARSENIDE SYSTEM
A. N.Krestovnikov et al 24 Jul. 1970 9 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSR (USSR), v. 180, no. 4, 1968 p 869–871
(NLL-RRE-Trans-282-(8036.625)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Theoretical analyses of the vapor pressures above solid solutions of the indium arsenide - gallium arsenide system are presented and the results of the theoretical calculations are evaluated by experiments with various compositions and temperatures. Comparison of calculated values with experimental curves after they have been averaged by the least squares method showed good agreement. It is concluded that despite the presence of a composition range in which the indium arsenide-gallium arsenide solid solutions are metastable, their transitions to thermodynamic equilibrium states did not occur. The low diffusion rates of the atoms of the components in the solution prevented such transitions. Author

N71-21751 Tulane Univ., New Orleans, La.
STRUCTURAL EFFECTS ON SUPERCONDUCTING THIN FILMS OF NIOBIUM
Michael Connella, III (Ph.D. Thesis) 1969 109 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 70-6288

This study was undertaken to find some correlation between structural modifications and superconducting properties of thin niobium films. Films were prepared in ultra-high vacuum by electron beam evaporation on polished MgO substrates. Films were examined by electron microscopy techniques. Initiating structures were observed to be mixed structures of NbO, fcc Nb, and bcc Nb with low deposition rates the controlling factor. As films deviated from the single crystalline structure, the resistivity values increased until the highest value obtained was for the mixed fcc and bcc structure. Superconducting electrical properties were observed for H > H sub c2 where surface superconductivity exists. Critical field values were measured for the film surface parallel and perpendicular to the applied magnetic field. These values were much higher for the films in the perpendicular orientation. Critical fields were found to vary linearly with resistivity for low resistivity values. Dissert. Abstr.

N71-21752# Virginia Univ., Charlottesville. Dept. of Aerospace Engineering and Engineering Physics.
APPLICATION OF LOW ENEGY MOLECULAR BEAMS TO THE DETERMINATION OF THE SURFACE PHONON SPECTRUM OF A CRYSTAL Final Report, Jun. 1968–Sep. 1969
Sam S. Fisher Jan. 1970 17 p refs
(Grant NSF GK-3376)
(AEEP-3824-101-70U) Avail: Issuing Activity

Research is reported aimed at learning more about the physical characteristics of crystal surfaces by observing the elastic and one-phonon inelastic scattering of atomic beams from these surfaces. LiF was chosen as the crystal to be used in the research and standard helium for the beam gas. Two types of beam sources were developed; a cryogenically cooled aerodynamic-type, and a fused-array type consisting of approximately 1000 small glass capillary tubes fused into a compact array. The preliminary results, including the shortcomings of the two types of beam sources, are discussed and recommendations for further studies in this area are suggested. D.L.G.

N71-21785# Texas Univ., Austin.
CALCULATIONS OF DYNAMICAL PROPERTIES OF SOLIDS Final Report
Frederik W. de Wette 1 Dec. 1970 13 p refs
(Grant AF-AFOSR-1257-67)
(AD-717167; AFOSR-70-2759TR) Avail: NTIS CSCL 20/12

A summary of proposed goals and achievements are given in the following areas: (1) Computer calculations of mechanical, /hermodynamic, and scattering properties of anharmonic crystals. (2) Computer calculations of these same properties for solid helium. (3) Studies and computer calculations of static and dynamical properties of crystal surfaces. Author (GRA)

N71-21805# California Univ., Berkeley. Lawrence Radiation Lab.
ELECTRON DIFFRACTION TECHNIQUE FOR THE DETERMINATION OF CRYSTALLINE STRUCTURE OF BETA GLYCINE
Wai-Kit Quon (Ph.D. Thesis) Oct. 1970 147 p refs
(Contract W-7405-eng-48)
(UCRL-20139) Avail: NTIS

Electron diffraction is applied to the investigation of the crystalline structure of beta glycine. The structure as determined by X-ray diffraction methods is used as a standard of the investigation. It is shown that the Patterson map is similar to the interatomic vector map calculated from the atom coordinates of the X-ray determined standard structure. Hence it can either be interpreted kinematically, or it is not sensitive enough to show moderate dynamical effects. The extent to which dynamical scattering limits the usefulness of electron diffraction intensity data for crystallographic determination has evident significance for the interpretation of high resolution structures that can be obtained by electron optical imaging of the scattered radiation. Author

N71-21806# Massachusetts Inst. of Tech., Cambridge.
THE STRUCTURE OF AMORPHOUS MATERIALS Semiannual Technical Report, 1 Jun.–30 Nov. 1970
B. L. Averbach 30 Nov. 1970 5 p ref
(Contract DAHC04-70-C-0045; ARPA Order 1582)
(AD-716810; AROD-9180.1-C; SATR-1) Avail: NTIS CSCL 20/12

The report describes investigations into the atomic arrangement in amorphous materials which are used as semiconductor switches. Amorphous As2Se3 has been selected as a typical threshold switch and amorphous Te85Ge15 as a typical memory switch. Small amounts of Te and Sb are usually added to As2Se3 to adjust the conductivity. In a similar way small amounts of As and Sb are usually added to Te85Ge15 to improve the switching lifetime. The author plans to investigate the structures with and without the alloy additions, but it is anticipated that there will be little change in the atomic arrangement in the doped material. It appears that there is considerable short range structure in these materials, and it is desired to correlate this structure with the switching characteristics. Author (GRA)

N71-21824* Honeywell, Inc., Minneapolis, Minn.
PIEZOELECTRIC PUMP Patent
Robert F. Anderson, inventor (to NASA) Issued 2 Jan. 1968 (Filed 9 Sep. 1966) 6 p Cl. 103-1 Sponsored (NASA-Case-XNP-05429; US-Patent-3,361,067; US-Patent-Appl-SN-578928) Avail: US Patent Office CSCL 20L

A fluid pumping apparatus is described that operates by piezoelectric effect. A piezoelectric plate produces high frequency oscillations for pumping the fluid through orifices and attains full fluid flow rectification without the use of conventional valving structure and moving parts. It is designed for supplying fluid to a gyroscope fluid suspension system as utilized in rockets and space vehicles. Official Gazette of the U.S. Patent Office

N71-21825 California Univ., Berkeley.
THE ASYMMETRIC DEFORMATIONS OF MOLYBDENUM SINGLE CRYSTALS
Silvanus Siu-Wai Lau (Ph.D. Thesis) 1969 67 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 70-6149

The tensile properties of Mo single crystals of six different orientations were investigated over the range from 20 K to 550 K. The plastic behavior shows asymmetry in the critical resolved shear stress for slip on both (110) planes and (112) planes. At low temperatures, within the thermally activated region, slip seems to take place on well defined crystallographic planes. At high temperatures in this range, however, slip takes place on irrational planes. The asymmetries associated with yielding and slip both increase with decreasing temperature. These effects are rationalized in terms of a modified Peierls model. The model assumes the asymmetric slip arises from a tendency toward asymmetric splitting of the core of the a/2 <111> screw dislocation. It is shown that the model can predict with reasonable accuracy the stress-temperature-strain rate-orientation relationship and the slip behavior. Dissert. Abstr.

N71-21830 National Lending Library for Science and Technology, Boston Spa (England).
PHOTOELECTRIC PROPERTIES OF GALLIUM ARSENIDE CONTAINING RADIATIVE DISARRANGEMENTS OF STRUCTURE [FOTOELEKTRICHESKIYE SVOISTVA ARSENIDA GALLIYA, SODERZHASHCHEGO RADIATSIONNYE NARUSHENIYA STRUKTURY]
A. N. Sevchenko et al Aug. 1970 4 p refs Transl. into ENGLISH from Dokl. Akad. Nauk Belorusak. SSR (Minsk), v. 10, no. 6, 1966 p 374–376
(NLL-RTS-5984) Avail: Natl. Lending Library, Boston Spa, Engl.: 8 s; 1 NLL photocopy coupon

The most sensitive method of measuring the energy levels of radiation defects is to study the structures of the spectra of the photoconductivity beyond the boundary of the main absorption band. This method was applied to the energy spectrum of the band gap levels in gallium arsenide monocrystals of n- and p- type, irradiated by different integral fluxes of fast reactor neutrons. Author

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N71-20829# Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
DRAFT OF CONTRACT SPECIFICATIONS FOR THE SUPPLY OF ASYMMETRIC DIMETHYL HYDRAZINE: OPERATING CONDITIONS [PROJET DE CAHIER DES CHARGES POUR LA FOURNITURE DE DIMETHYLHYDRAZINE DISSYMETRIQUE: MODES OPERATOIRES]
29 Sep. 1969 36 p in FRENCH Sponsored by Soc. Pour l'Etude et la Realisation d'Engins Balistiques
(LRBA-NT-75/69/SET/EP) Avail: NTIS

Standard control procedures adopted by the French space authorities for acceptance of asymmetric dimethyl hydrazine are listed. ESRO

N71-21355*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLID PROPELLANT ENGINEERING
In its Space Programs Sum. No. 37-66, Vol. 3, Oct.–Nov. 1970 31 Dec. 1970 p 175–186 refs (See N71-21338 10-30)
Copyright. Avail: NTIS CSCL 21I

The isolation and dissection of a dual bridgewire squib which displayed an abnormal response to nondestructive tests is described; microscopic examination of the circuit established faulty weld connections as the inductors of failure modes. Low pressure combustion limits for long burning high performance motors were determined for three propellants, each containing 16% aluminum and ammonium perchlorate as oxidizer; strand bomb burning rates versus pressure data were affected principally by the presence of aluminum, the concentration of aluminum, and the particle size of the aluminum in the propellants. The intensity of a high-order Gaussian laser beam was determined as a function of aperture size and oscillating mode index; results show that the use of the lowest possible mode is desirable. G.G.

N71-21522 Virginia Polytechnic Inst., Blacksburg.
ACCELERATION INDUCED TRANSIENT BURNING RATE AUGMENTATION OF AN ALUMINIZED SOLID ROCKET PROPELLANT
George Burton Northam (Ph.D. Thesis) 1969 131 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 70-5363

The acceleration-induced transient burning-rate augmentation of a polybutadiene acrylic acid propellant containing 16 weight percent of aluminim was characterized with centrifugal acceleration loads from 0 to 140 g, normal and into the burning surface. Instantaneous burning-rate data were calculated from the pressure histories of a test motor with 15 square inches of burning area and a 2.0 inch thick propellant web. Additional acceleration tests were conducted using propellant web thicknesses of 1.5, 1.0, 0.5 inches. The metallic residue retained from the various web thickness tests were analyzed and correlated with the instantaneous burning-rate measurements. Extinction tests were conducted at various times and acceleration levels in order that surface pitting due to localized increased burning rates could be correlated with the residue analysis and the instantaneous burning rate data. Dissert. Abstr.

N71-21633# Ballistic Research Labs., Aberdeen Proving Ground, Md.
SCATTERING OF STRESS WAVES BY INHOMOGENEITIES IN SOLID PROPELLANT MATERIALS
Adam R. Zak Oct. 1970 41 p refs
(AD-717001; BRL-MR-2069) Avail: NTIS CSCL 21/9

The scattering and the attenuation of stress waves in solid propellant materials is examined. These phenomena are due to the fact the propellant is a nonhomogeneous material on the length scale equivalent to that of the size of the oxidizer particles. The analysis considers waves traveling in a semi-infinite, one-dimensional model and it is in two parts. The first part deals with the scattering of a sinusoidal wave and the results are given in terms of the mean square value of the scattered wave. The second portion of the analysis is concerned with the attenuation of a square pulse

applied at the free end. Both of these analyses consider the nonhomogeneous properties to be random and characterized by a statistical model. The results for both types of waves show that the nonhomogeneous properties have an appreciable effect when the wave length of the waves approach the characteristic length of the nonhomogeneities. Author (GRA)

N71-21746 National Lending Library for Science and Technology, Boston Spa (England).

REACTION OF WATER VAPOUR AND THE CARBON IN SOLID FUEL UNDER PRESSURE [VZAIMODEISTVIE VODYANOGO PARA S UGLERODOM TUERDOGO TOPLIVA POD DAVLENICM]

A. D. Kokurin et al Sep. 1970 7 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Teknol. (USSR), v. 11, 1967 p 1241–1244

(NLL-RTS-5837) Avail: Natl. Lending Library, Boston Spa, Engl.: 14s; 2 NLL photocopy coupons

Experimental evidence was obtained on some of the laws governing the reaction between water vapor and the carbon in solid fuel, the nature and influence of chemisorption phenomena and their responses to temperature and pressure changes. The reactions between water vapor and solid fuel carbon are much more complicated than those involving oxygen and carbon dioxide, especially at increased pressures. As soon as the gas stream has passed beyond the first layer of fuel, the reactions of carbon with H2O, and CO2 occur side by side. H2O, CO2, CO, H2 and CH4 are all affected by chemisorption phenomena and the thermal stability of the chemisobed groups of atoms depend on the temperature, the pressure and their nature. Author

N71-21819* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

BURNING RATE CONTROL OF SOLID PROPELLANTS

Patent

Louis A. Povinelli and Marcus F. Heidmann, inventors (to NASA) Issued 10 Oct. 1967 (Filed 17 Feb. 1966) 3 p Cl. 60-251

(NASA-Case-XLE-03494; US-Patent-3,345,822; US-Patent-Appl-SN-529593) Avail: US Patent Office CSCL 21I

Control of the burning rate of solid propellants by injecting pressurized hot gases into a rocket combustion chamber is reported. These gases are injected tangentially around the longitudinal wall of the combustion chamber in a direction transversed to the longitudinal axis of the rocket motor.

Official Gazette of the U.S. Patent Office

N71-21836 National Lending Library for Science and Technology, Boston Spa (England).

METHOD OF ASSESSING AND SELECTING ADDITIVES FOR LIQUID FUEL

J. M. Hoeke 21 Jul. 1970 27 p refs Transl. into ENGLISH from Ann. de l'Inst. Belge du Petrole, no. 3, 1969 p 41–55

(NLL-CE-Trans-5408-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

A brief review of fuel consumption over the past ten years and the relative advantages and disadvantages of different types of fuels is presented. Analyzed is the influence of additives in improving the quality of fuel oils and presented is an experimental method for choosing the best additive for a particular fuel oil. Author

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N71-20674*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A SUPERSONIC INLET-ENGINE CONTROL USING ENGINE SPEED AS A PRIMARY VARIABLE FOR CONTROLLING NORMAL SHOCK POSITION

Francis J. Paulovich, George H. Neiner, and Ralph E. Hagedorn Washington Mar. 1971 43 p refs

(NASA-TN-D-6021; E-5492) Avail: NTIS CSCL 21A

A cross coupled inlet engine control system concept is presented for a supersonic propulsion system consisting of a mixed compression inlet and a turbojet engine. The control system employs manipulation of both bypass door flow area and engine speed to stabilize normal shock position in the inlet. Specifically, the case of slow-acting bypass doors used as a reset control where engine speed is the primary means of shock position control is described. Experimental results are presented showing performance of the control system with a NASA-designed inlet and a turbojet engine operating at Mach 2.5 in the Lewis 10- by 10-Foot Supersonic Wind Tunnel. Author

N71-20771# Instituto Nacional de Tecnica Aeronautica, Madrid (Spain).

A COMPARATIVE STUDY OF CHEMICAL AND NONCHEMICAL PROPULSION SYSTEMS FOR ATTITUDE CONTROL AND ORBIT CORRECTION OF GEOSTATIONARY SATELLITES OF THE TYPE 500 TO 1000 KG. PART A: STATEMENT OF THE CHARACTERISTICS OF THE SYSTEMS

C. S. Tarifa, J. L. Urrutia, E. Fraga, A. Munoz, and A. Crespo 1970 78 p refs

(Contract ESTEC-912-70-HP)

Avail: NTIS

A comparison is given of a number of propulsion systems suitable for application to orbit correction, attitude control, and station keeping of geostationary satellites. Some chemical and nonchemical (electrothermal, electrostatic, and radioisotopic) propulsion systems are described and characteristics such as thrust control, thrust vectoring, specific impulse, response time, and state of development are compared. ESRO

N71-20832# National Gas Turbine Establishment, Pyestock (England).

LIQUID AND VAPOUR COOLING SYSTEMS FOR GAS TURBINES

J. P. Edwards London Aeron. Res. Council 1970 18 p refs Supersedes ARC-30986

(ARC-CP-1127; ARC-30986) Copyright. Avail: NTIS; HMSO: 25p; BIS: $1.00

The application of several types of liquid and vapor cooling systems to gas turbine blades is discussed. Emphasis is placed on systems suitable for continuous operation. The application of the heat pipe concept to stator blade cooling is discussed in some detail and a tentative design study presented. Author (ESRO)

N71-20940*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

MATHEMATICAL REPRESENTATION OF CURRENT DENSITY PROFILES FROM ION THRUSTERS

Thaine W. Reynolds [1971] 17 p refs Proposed for presentation at 7th Propulsion Joint Specialist Conf., Salt Lake City, 14–18 Jun. 1971; sponsored by AIAA

(NASA-TM-X-52992) Avail: NTIS CSCL 21C

A concise and convenient way of expressing ion beam spreading characteristics is presented. A two parameter equation is shown to be capable of representing experimental beam current density profiles from several bombardment ion thrusters. This is a far field expression. A calculation of the development of the profiles downstream of an extended source indicates that ion beam profiles should be taken at least eight thruster radii away to be

representative of the far field behavior of the beam. Parametric plots of thrust factor, ion beam envelopes, and back sputtering due to ion beam erosion illustrate the use of the ion beam equation in beam interaction calculations. Experimental ion beams illustrated had thrust factors varying from 0.95 to near 1.0. Author

N71-20942* Marquardt Corp., Van Nuys, Calif.
MULTISLOT FILM COOLED PYROLYTIC GRAPHITE ROCKET NOZZLE Patent
Clifford D. Coulbert and John G. Campbell, inventors (to NASA) Issued 21 Nov. 1967 (Filed 26 Jan. 1966) 5 p Cl. 60-265 Sponsored by NASA
(NASA-Case-XNP-04389; US-Patent-3,353,359; US-Patent-Appl-SN-523511) Avail: US Patent Office CSCL 21H

A gas generating device, such as a rocket engine, is described which has a thrust chamber or nozzle wall comprised of a stacked series of pyrolytic graphite wafers or washers. Passages through the washers, in the longitudinal direction of the engine, allow for the flow of coolant. Alternatively, an annular manifold surrounding the washers can provide coolant for distribution to the various washers. Upon introduction of coolant into the longitudinal passages or manifold, a portion of the coolant will pass out through each of the grooves so as to be injected along the nozzle wall to act as a film coolant. D.L.G.

N71-21357*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RESEARCH AND ADVANCED CONCEPTS
In its Space Programs Sum. No. 37-66, Vol. 3, Oct. - Nov. 1970 31 Dec. 1970 p 201 -212 refs (See N71-21338 10-30)
Copyright. Avail: NTIS CSCL 21C

The effect of electron baffle geometry on ion thruster efficiency was studied by measuring arc chamber losses during thruster operation; as baffle diameter was reduced, arc chamber losses were reduced and minimized near a diameter of 4.5 cm for low power operation. An ion thruster utilizing a combination keeper electrode and electron baffle provided stable thrusts during automatic operation with a power conditioning unit. A method is described for estimating mass and dimensions of the thrust subsystem for a nuclear electric spacecraft that spirals into escape velocity to obtain the Jupiter orbit. Solar electric propulsion system tests that involve integration of a power conditioner with an ion thruster, found that arcing occurred between disconnected pins and leads due to the proximity of high potential and low potential lines; modifications of connector and connector pins diminished leakages and the thruster operated successfully. G.G

N71-21358*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LIQUID PROPULSION
In its Space Programs Sum. No. 37-66, Vol. 3, Oct. - Nov. 1970 31 Dec. 1970 p 213 -232 refs (See N71-21338 10-30)
Copyright. Avail: NTIS CSCL 21I

Dynamic throttling and heat sterilization tests are reported for a high thrust throttleable monopropellant hydrazine reactor. Dynamic control of the throttle valve from a pre-recorded signal was demonstrated and no problems in the rapid throttling of a hydrazine decomposition chamber were encountered. Heat sterilization had a significant effect only on subsequent reactor start transient characteristics. Injector hydrodynamic effects on baffled engine stability were examined by correlating required baffle geometry with injected mass flux; it was found that baffle length required for dynamic stability is primarily controlled by the concentration of unreacted propellants in the early reaction region of the chamber. G.G.

N71-21483* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NACELLE AFTERBODY FOR JET ENGINES Patent
Mark R. Nichols, inventor (to NASA) Issued 17 Oct. 1967 (Filed 15 Nov. 1966) 13 p Cl. 239-265.19 Continuation-in-part of US Patent Appl. SN-262297, filed 28 Feb. 1963
(NASA-Case-XLA-10450; US-Patent-3,347,466; US-Patent-Appl-SN-594587) Avail: US Patent Office CSCL 21E

An afterburner-equipped jet engine nacelle is described. It involves the addition of several three-dimensional bodies, or horns, extending aft from the steep portion of the boattail portion of the nacelle and from any blanked-off portion of the nacelle base. In this way, a slotted surface is formed aft of the annular base surrounding the nozzle of the primary jet. This addition is designed, in accordance with the principles of the equivalent-body theory, to effectively increase the ratio of nacelle body length to the maximum diameter of the body, and to reduce the slope of the boattail. Experiments indicate that the afterbodies can be hinged to the nacelle and diverted by actuation to provide a thrust-reversing device. D.L.G.

N71-21717*# Avco Corp., Wilmington, Mass. Systems Div.
QUASI-STEADY MPD PROPULSION AT HIGH POWER Final Technical Report
A. C. Mellaris, R. R. John, R. L. Garrison, and D. R. Libby Feb. 1971 102 p refs
(Contract NAS1-9939)
(NASA-CR-111872; AVSD-0146-71-RR) Avail: NTIS CSCL 21C

An investigation of quasi-steady MPD propulsion at power levels in the range 1 to 10 megawatts is presented. An axisymmetric configuration was used for the MPD thruster, (3 inch anode, 3/4 inch, cathode), and a complete laboratory assembly provided current pulses in the range 5 to 50 kiloamperes and propellant pulses in the range zero to 30 gm/sec argon, with typical durations about 1 millisecond. In addition to argon, all other noble gases were investigated as propellants. Empirical observations, supported also by an analytical discussion, show that the square of the MPD current divided by the mass flow rate is a very important parameter. This parameter has a critical limit, above which the operation of the thruster becomes increasingly unacceptable. This limit has been found to depend inversely on the square root of the molecular weight of the propellant. Evaluation of the MPD thruster is carried out by means of MPD electrode calorimetry, flow velocity measurements, and impulse bit measurements. Author

N71-21799# Massachusetts Univ., Amherst.
OPTIMIZATION OF SUPERSONIC ROCKET NOZZLES WITH VISCOUS FLOW Final Report
H. U. Hwang and S. N. B. Murthy Oct. 1970 153 p refs
(Contract F33615-68-C-1053)
(AD-716859; ARL-70-0240) Avail: NTIS CSCL 21/8

The determination of the optimum shape of a supersonic (rocket motor) nozzle, under the constraint of a given surface area, while taking into account the effects of viscous action and heat conduction, is the objective of the investigation. In the case of a nozzle (low density or low Reynolds number) where the effects of viscous action and heat conduction extend over the entire flow field, the optimization problem for a conical nozzle was solved on the basis of postulated similar solutions. For more general application, where a thin boundary layer can be postulated, the optimization of a contoured (axisymmetric) nozzle was undertaken by adopting one of two approaches, namely one involving a physical boundary layer region and another involving the displacement thickness of the boundary layer. In both cases, it is the objective to consider the inviscid and the viscous regions governed by appropriate flow equations simultaneously in determining the necessary conditions. This method of subjecting two simply-connected regions simultaneously to optimization is developed for the first time and can be extended in many directions. Author (GRA)

N71-21822* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ELECTRON BOMBARDMENT ION ENGINE Patent
Tommy D. Masek, inventor (to NASA) Issued 10 Oct. 1967 (Filed

19 Oct. 1965) 4 p Cl. 60-202 Sponsored by NASA (NASA-Case-XNP-04124; US-Patent-3,345,820; US-Patent-Appl-SN-498168) Avail: US Patent Office CSCL 21C

An ion engine in which an anode is centrally mounted in a housing, with a porous cathode coaxially mounted about the anode to define an ionization chamber is expected. A potential source, connected to the anode and cathode, provides a radial electrical field in the chamber. A coil, wound about the cathode, serves to heat the cathode as well as provide an axial magnetic field perpendicular to the electrical field. Propellant gas is injected into the chamber through the cathode, continuously coating it to reduce its work function and to control the uniform spatial ion distribution within the chamber. Official Gazette of the U.S. Patent Office

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N71-20715# Royal Netherlands Aircraft Factories Fokker, Amsterdam. Space Dept.

MEASUREMENT OF UV-RADIATION DOSAGE

V. D. Vegt 8 Jan. 1971 19 p
(Contract ESTEC-647-69-AA)
(RV-51) Avail: NTIS

The method used to estimate the UV radiation dosage received by samples in combined UV/vacuum exposure test is described. Author (ESRO)

N71-20773# Aerospace Corp., El Segundo, Calif. Lab. Operations.

TRANSPORT AND LOSS PROCESSES FOR MAGNETOSPHERIC HELIUM Technical Report, Jun. -Aug. 1970

John M. Cornwall 14 Dec. 1970 19 p refs
(Contract F04701-70-C-0059)
(AD-717154; TR-0059(6260-20)-11; SAMSO-TR-70-435) Avail: NTIS CSCL 4/1

The distribution and charge composition of ionized helium and other heavy ions on closed field lines and in the auroral zone, the transport and loss processes of these ions themselves, and the corresponding processes for protons are discussed. There are at least three, and possibly more, sources of helium at the outer boundary of the trapping zone, where radial diffusion is considered to begin. These sources are: (1) solar wind particles, (2) ionospheric particles blown out in the polar wind, and eventually accelerated and injected into the tail, and (3) direct injection of energetic solar protons and alpha particles. Author

N71-21492*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

EXPLORER 35 OBSERVATIONS OF SOLAR WIND ELECTRON DENSITY, TEMPERATURE AND ANISOTROPY

G. P. Serbu Mar. 1971 35 p refs Submitted for publication
(NASA-TM-X-65481; X-625-71-92) Avail: NTIS CSCL 03C

Measurements of the electron integral spectrum yield electron temperatures in the range from 1 to 500,000 K, electron densities at an average value of 4.6/cu cm, and electron temperature anisotropies in the range from 1 to 1.4. The electron temperature is found to be independent of solar wind speed over the range from 290 to 675 km/sec. Comparison between the simultaneous alignment of the local magnetic field vector and the direction of the anisotropy reveals a high correlation, indicating that under average conditions the electron energy flow in the solar wind is field aligned. Short-duration field aligned increases in anisotropy associated with large geomagnetic disturbances were measured to values as high as 3.4. The left-hand mode of the Firehose instability was observed in the electron plasma immediately behind an interplanetary shock. Author

N71-21545# Universidad Mayor de San Andres, La Paz (Bolivia). Lab. de Fisica Cosmica.

SUMMARIES OF RESEARCH PROJECTS FOR 1969, NO. 33 [RESUMEN DE LABORES, ANO 1969, CUADERNO NO. 33]

Gaston R. Mejia, ed. Feb. 1970 258 p refs In SPANISH
Avail: NTIS

CONTENTS:

1. DIURNAL SOLAR VARIATIONS OF UNDERGROUND COSMIC RAY OBSERVATIONS SINCE 1958 V. H. Regener, D. B. Swinson, J. H. Ericksen, and H. Ahluwalia (N.Mex. Univ., Albuquerque) p 41–53 refs (See N71-21546 10-29)

2. DIURNAL SIDERAL VARIATIONS OF COSMIC RAYS D. B. Swinson (N.Mex. Univ., Albuquerque) p 55–82 refs (See N71-21547 10-29)

3. HIGH ENERGY NUCLEAR INTERACTIONS OBSERVED AT 5200 m ABOVE SEA LEVEL K. Kamata, T. Maeda, P. K. McKeown, C. Aguirre, A. Trepp et al p 83–106 refs (See N71-21548 10-29)

4. AN ANALYSIS OF STORMS WITH FEW MUONS I. Escobar, M. La Pointe, and G. B. Yodh (Md. Univ., College Park) p 108–119 refs (See N71-21549 10-24)

5. CHEMICAL COMPOSITION OF PRIMARY COSMIC RAYS OF 1000 TeV S. A. Rappaport and H. V. Bradt (MIT, Cambridge) p 21–133 refs (See N71-21550 10-29)

6. CERENKOV LIGHT IN EXTENSIVE ATMOSPHERIC STORMS AND THE CHEMICAL COMPOSITION OF PRIMARY COSMIC RADIATION AT 1000 TeV A. S. Krieger and H. V. Bradt (MIT, Cambridge) p 135–171 refs (See N71-21551 10-29)

7. MUONS IN ATMOSPHERIC STORMS WITH ENERGY LEVELS GREATER THAN 100000 TeV K. Suga, S. Shibata, S. Mikamo (Tokyo Univ., Japan), Y. Toyoda (Kobe Univ.), K. Murakami (Inst. of Phys. and Chem. Res., Tokyo, Japan) et al p 173–186 refs (See N71-21552 10-13)

8. RADIO STORMS ON MONTE CHACALTAYA W. E. Hazen, A. Z. Hendel, H. Smith, and N. J. Shah (Mich. Univ., Ann Arbor) p 187–204 refs (See N71-21553 10-13)

9. HADRON SPECTRUM IN THE ATMOSPHERE R. Ellsworth and G. B. Yodh (Md. Univ., College Park) p 205–217 (See N71-21554 10-13)

N71-21546# New Mexico Univ., Albuquerque. Dept. of Physics and Astronomy.

DIURNAL SOLAR VARIATIONS OF UNDERGROUND COSMIC RAY OBSERVATIONS SINCE 1958 [LA VARIACION SOLAR DIURNA DE RAYOS COSMICOS OBSERVADOS BAJO TIERRA DESDE 1958

Victor H. Regener, Derek B. Swinson, Jacqueline H. Ericksen, and Harjit Ahluwalia *In* Univ. Mayor de San Andres Sum. of Res. Proj. for 1969, No. 33 Feb. 1970 p 41–53 refs In SPANISH Presented at the 11th Intern. Conf. on Cosmic Radiation, Budapest, 25 Aug.–4 Sep. 1969 (See N71-21545 10-29)
(Grant NSF GA-1513)
Avail: NTIS

The results of underground observations of the cosmic ray flux obtained since 1958 in Bolivia and New Mexico are presented with the experimental techniques used. Three stations were in operation: one in Bolivia, and two in New Mexico. In each station multiple scintillating telescopes with double coincidence were installed. The results are presented as functions of diurnal variations of the solar cycle, depth, telescope inclination, and the interplanetary magnetic field. Transl. by F.O.S.

N71-21547# New Mexico Univ., Albuquerque. Dept. of Physics and Astronomy.
DIURNAL SIDERAL VARIATIONS OF COSMIC RAYS [VARIACION SIDERAL DIURNA DE LOS RAYOS COSMICOS]
Derek B. Swinson *In* Univ. Mayor de San Andres Sum. of Res. Proj. for 1969, No. 33 Feb. 1970 p 55–82 refs In SPANISH Submitted for publication (See N71-21545 10-29)
(Grants NSF GA-324; NSF GA-762; NSF GA-1513)
Avail: NTIS

Data presented are obtained by underground muon telescopes installed at a depth of 40 meters in the Northern and Southern Hemispheres. It was found by sideral time analysis of three years of data from the telescopes of the Northern Hemisphere and those of the Southern Hemisphere pointed to the North, that the maximum intensity is at 18 hours (sideral Time). A sideral time model is proposed that produces the cosmic radiation density gradients near the earth and in the interplanetary magnetic field. Transl. by F.O.S.

N71-21548# Universidad Mayor de San Andres, La Paz (Bolivia). Lab. de Fisica Cosmica.
HIGH ENERGY NUCLEAR INTERACTIONS OBSERVED AT 5200 m ABOVE SEA LEVEL [INTERACCIONES NUCLEARES DE ALTA ENERGIA OBSERVADAS A 5.200 m. SOBRE EL NIVEL DEL MAR]
K. Kamata, T. Maeda, P. K. McKeown, C. Aguirre, A. Trepp et al *In its* Sum. of Res. Proj. for 1969, No. 33 Feb. 1970 p 83–106 refs In SPANISH Presented at the 11th Intern. Conf. on Cosmic Radiation, Budapest, 25 Aug.–4 Sep. 1969 Sponsored in part by the Bolivian Govt., the Japan Min. of Educ., the Japan. Soc. for Sci. Develop., Japan. Ind., OAS, and AFOSR Prepared in cooperation with Kobe Univ., Tokyo Univ., Inst. of Phys. and Chem. Res., Tokyo, and Md. Univ., College Park (See N71-21545 10-29)
Avail: NTIS

High energy nuclear reactions in air without storms were studied at Monte Chacaltaya, Bolivia. The reactions were produced by primary protons impinging on the scintillator coating. The broad spectra of these reactions are graphed as exponential power functions, and the energy spectra of these protons, in the region of 3×10 to the 12th power to 10 to the 14th power, are estimated from the reaction spectra. These reactions are considered to constitute a great percentage of the total energy spectrum of primary cosmic radiation. Transl. by F.O.S.

N71-21550# Massachusetts Inst. of Technology, Cambridge.
CHEMICAL COMPOSITION OF PRIMARY COSMIC RAYS OF 1000 TeV [COMPOSICION QUIMICA DE LOS RAYOS COSMICOS PRIMARIOS DE 1000 TeV]
Saul A. Rappeport and Hale V. Bradt *In* Univ. Mayor de San Andres Sum. of Res. Proj. for 1969, No. 33 Feb. 1970 p 121–133 refs In SPANISH Submitted for publication (See N71-21545 10-29)
(Contracts F44620-67-C-0020; AT(30-1)-2098)
Avail: NTIS

The chemical composition of nuclear particles of extensive atmospheric storms was analyzed. The approximate composition was found to be 49% H, 26% He, 2% Li + Be + B, 11% medium numbered nuclei, and 7% very heavy nuclei. The data are consistent with that observed with energies below 10 to the 11th power. Transl. by F.O.S.

N71-21551# Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.
CERENKOV LIGHT IN EXTENSIVE ATMOSPHERIC STORMS AND THE CHEMICAL COMPOSITION OF PRIMARY COSMIC RADIATION AT 10000 TeV [LUZ DE CERENKOV EN CHUBASCOS EXTENSOS EN LA ATMOSFERA Y LA COMPOSICION QUIMICA DE LA RADIACON COSMICA PRIMARIA A 10000 TeV]
Allen S. Krieger and Hale V. Bradt *In* Univ. Mayor de San Andres Sum. of Res. Proj. for 1969, No. 33 Feb. 1970 p 135–171 refs In SPANISH Sponsored in part by Japan. Min. of Educ. and the Bolivian Govt. (See N71-21545 10-29)
(Contracts F44620-67-C-0020; AT(30-1)-2098)
Avail: NTIS

The system of Cerenkov light detectors in use at Monte Chacaltaya, which is capable of detecting star light of 10,000 photons/sq m, is described. In an analysis of the data obtained from July to November in 1966, and 1967, the intensity distribution of the Cerenkov radiation (normalized with respect to magnitude and radio constants) indicates that the primary cosmic rays of 10 to the 16th power eV present a mix in chemical composition similar to that at 10 to the 12th power eV. Transl. by F.O.S.

N71-21563*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THREE INVESTIGATIONS OF THE INTERSTELLAR MEDIUM
Klaus Schocken 11 Feb. 1971 30 p refs
(NASA-TM-X-64577) Avail: NTIS CSCL 03C

The investigations reported include the following: (1) A study of the attentuation of X-rays in space is presented with mathematical determinations of the absorption and scattering coefficients, the distribution of interstellar matter, and the radiative transfer in an absorbing-scattering cloud. (2) The attentuation of X-rays in the interstellar medium and in intergalactic space is analyzed and numerical computations of the attenuation, along with approximate characteristic values of the interstellar medium, are given. (2) The physical state of a hydrogen cloud is reviewed and a model for obtaining the diffusion velocity is presented. D.L.G.

N71-21564*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A U-TYPE SOLAR RADIO BURST ORIGINATING IN THE OUTER CORONA
R. G. Stone and Joseph Fainberg Mar. 1971 14 p refs
(NASA-TM-X-65484; X-693-71-107) Avail: NTIS CSCL 03B

A discussion is presented of the very rare occurrence of a U-type burst observed between 5 and 0.7 MHz by RAE-1. A possible model is developed from the data. In terms of the model, in which the exciter moves along a magnetic loop, the observations suggest that such loops or magnetic bottles can extend out to the order of 35 solar radii. Author

N71-21565*# Texas Univ., Dallas.
[PIONEER 8 AND 9 DATA TAPE ANALYSIS] Final Report
[1971] 3 p refs
(Grant NGR-44-004-108)
(NASA-CR-117526) Avail: NTIS CSCL 03C

A partial list of current studies and results from data tape analysis are presented. The list includes studies of: (1) the heliocentric longitude density gradient, (2) the decay phase of the solar flare effects, (3) the anisotropic particle propagation of solar injected cosmic radiation, (4) low energy particle propagation during specific solar flare effects, and (5) the co-rotating electron event of 13 July 1968. D.L.G.

N71-21620# Clarkson Coll. of Technology, Potsdam, N.Y. Dept. of Physics.
SPARK CHAMBER SPECTROMETRY AND SPACE RADIATION STUDIES Final Report, 15 Oct. 1965–14 Oct. 1970
Richard Madey, G. Thomas Huetter, and Stephen M. Yushak 14 Jan. 1971 55 p refs
(Contract AF 19(628)-5668)
(AD-716843; CPDD-71-1; AFCRL-70-0684) Avail: NTIS CSCL 4/1

Advances in instrumentation based on the spark-chamber technique for making charged particle studies of the aerospace

environment have included the development of spark-discharge modules that are sealed against the space environment, a high-voltage generator with a long lifetime for use with spark chambers in space, a passive readout technique for spark-discharge counters, and a method of applying a clearing field that consumes no power. Analytical expressions have been derived for the flux of protons within cylindrical shell and slab disk shields exposed to protons in space. Reported also are studies in space radiation dosimetry. GRA

N71-21653*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

IONIZATION AND HEATING OF THE GUM NEBULA BY ENERGETIC PARTICLES FROM THE VELA X SUPERNOVA

R. Ramaty, E. A. Boldt, S. A. Colgate (N.Mex. Tech. Inst.), and J. Silk (Calif. Univ., Berkeley) Mar. 1971 25 p refs
(NASA-TM-X-65486; X-660-71-117) Avail: NTIS CSCL 03B

A model is investigated in which the Gum Nebula is ionized and heated by energetic particles from the supernova associated with the Vela X remnant. It was found that the observed ionization could be produced in 10,000 to 20,000 years by the ejection of about 1 to 2 solar masses of the products of silicon burning at a mean energy of a few MeV/nucleon. The consequences of this model for the ionization and heating of the interstellar medium, the generation of the light elements, X-ray production, and observable cosmic rays are investigated. Author

N71-21837# Lockheed Missiles and Space Co., Palo Alto, Calif.

ON THE THERMAL MODEL OF ACTIVE REGIONS OF THE SOLAR CORONA

I. L. Beigman et al [1970] 9 p refs Transl. into ENGLISH from Astron. Zh. (Moscow), v. 47, no. 5, 1970 p 1030–1037
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Fluxes have been calculated in the resonance lines of the most abundant ions of the solar corona. Utilizing these computations, the possibility of describing experimental results within the scope of a theoretical model of the active region of the solar corona is discussed. Available data are described by using the model of one of two kinds: (1) domain with a small measure of emission and sharp temperature boundaries; and (2) domain with a large measure of emission and smooth temperature distribution. Author

N71-21838 Missouri Univ., Columbia.

ESTIMATES OF POTENTIAL PRODUCTIVITY FROM THE CLIMATOLOGY OF PHOTOSYNTHETICALLY ACTIVE SOLAR RADIATION

Juanito Marasigan Ramirez (Ph.D. Thesis) 1969 142 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 70-6625

The spectral distribution of the solar radiation reaching the earth's surface was calculated according to the exponential relationship suggested by Moon. In using this empirical model, more modern information on the extinction coefficients of atmospheric constituents were considered. The energy estimates for various sun elevations were converted into units of mole-quanta intensity, and were integrated to yield daily values of solar radiation for different dates and latitudes. The energy contained in the visible portion of the spectrum was shown to be about 41 to 45 per cent of the energy in the entire solar spectrum when the energy is expressed in units of flux densities, and about 28 to 30 per cent of the total radiation if the energy is expressed in einsteins. Dissert. Abstr.

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N71-20632# Joint Publications Research Service, Washington, D.C.

SPECIAL PROBLEMS OF PHYSICS AND ASTROPHYSICS TODAY

V. L. Ginzburg 12 Mar. 1971 42 p refs Transl. into ENGLISH from Usp. Fiz. Nauk (Moscow), v. 103, no. 1, 1971 p 87–119
(JPRS-52607) Avail: NTIS

The problems considered most important in physics and astrophysics are discussed. These include: controlled thermonuclear fussion; high temperature conductivity; metallic hydrogen, and anomalous water; metal exciton fluid in semiconductors; and singularities in the general theory of relativity and cosmology. F.O.S.

N71-20633# Centre Universitaire de l'Etat a Mons (Belgium). Dept. d'Astrophysique.

PREDICTED ULTRAVIOLET FLUXES FOR MAIN SEQUENCE STARS

E. Blondelot 1970 25 p refs *Its* Commun. No. 12
Avail: NTIS

A comparison is made of theoretical and observational results in order to determine whether spectral types derived according to spectral features in the visible part of the spectrum are really characteristic of one star and can be considered as valuable during ultraviolet observations. Results are applied to the spectrum of the sun and to interstellar extinction. ESRO

N71-20637*# IIT Research Inst., Chicago, Ill.

A PRELIMINARY STUDY OF COMPOSITE ORBITER/LANDER MISSIONS TO SATELLITES OF THE OUTER PLANETS

M. J. Price and D. J. Spadoni Sep. 1970 65 p refs
(Contract NASw-2023)
(NASA-CR-117428; IITRI-M-25) Avail: NTIS CSCL 22A

Scientific objectives and payload requirements for landing unmanned spacecraft on satellites of the four giant outer planets are reported. Specific missions to Io (Jupiter 1), Europa (Jupiter 2), Ganymede (Jupiter 3), Callisto (Jupiter 4), Titan (Saturn 6), and Triton (Neptune 1) were considered. Composite orbiter/lander type missions, similar to Viking-Mars, were examined. Results indicate that missions to all of the satellites considered are possible with either a Saturn launch vehicle with a high energy (ballistic) upper stage, or a Titan launch vehicle with a nuclear-electric stage. Missions to Ganymede, Callisto and Titan are possible with a Saturn launch vehicle and solar-electric upper stage. Author

N71-20661# Milan Univ. (Italy). Inst. of Physics.

DIFFUSION OF ELECTRONS IN SAGITTARIUS A

Laura Maraschi, Massimo Tarenghi, and Aldo Treves 1970 16 p refs Sponsored partly by the Brit. Council at the Univ. of Cambridge
Avail: NTIS

A model of Sagittarius A in which electrons diffuse from a point source is discussed. The different radio spectra observed with small and wide apertures and the variation of the radius with the frequency are interpreted. The injection of cosmic ray electrons from Sagittarius A into the galaxy is examined. Author (ESRO)

N71-20781# Centre Universitaire de l'Etat a Mons (Belgium). Dept. d'Astrophysique.

NEAR INFRARED CHANGES IN NOVA DELPHINI 1967 IN 1969 [EVOLUTION DU SPECTRE DE LA NOVA DELPHINI 1967 DANS LE PROCHE INFRAROUGE EN 1969]

Yvette Andrillat (Montpellier Univ.) and Leo Houziaux 1970 16 p refs In FRENCH *Its* Commun. No. 17
Avail: NTIS

Spectra of Nova Delphini 1967 have been obtained in the photographic infrared during the period March to November

1969. The gradient in the region 1.3 to 1.7 per micron has decreased from 3.06 in November 1968 to 2.57 in November 1969. The main spectral features occurring in the wavelength range 5800 A to 9600 A are described. Author (ESRO)

N71-20775# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMPLEX, GLOBAL
23 Oct. 1970 6 p Transl. into ENGLISH from Pravda (Moscow), 19 Jun. 1970 p 3
(AD-717045; FTD-HT-23-703-70) Avail: NTIS CSCL 22/2

The part played by the satellites Kosmos-348 and Kosmos-261 in complex geophysical investigations carried out by the Soviet Union and nations of The East European Bloc is discussed. The item is intended for lay readers. Author (GRA)

N71-20911# European Space Research Inst., Frascati (Italy).
NATURAL MODES OF THE ACOUSTIC-GRAVITY TYPE ON A SIMPLIFIED SOLAR ATMOSPHERE
James F. Mc Kenzie 1970 35 p refs Submitted for publication
Avail: NTIS

The dispersion equation is derived for the natural modes of a simple model of the solar atmosphere which consists of a slab of gas bounded above by a hot gas and below by a cool gas, all under the action of gravity. The periods of the natural modes, which are of the character of standing acoustic waves within the slab, are confined to a fairly narrow band which is in agreement with the 5-minute periodicity observed in the gas motions in the photosphere and chromosphere. By identifying the observed oscillations with these natural modes other observed features of the oscillations, which are in apparent conflict with each other, can be resolved. Author (ESRO)

N71-20929*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DYNAMICAL ERROR ANALYSIS IN ORBIT DETERMINATION SYSTEMS
N. L. Bonavito and Stan Watson Jan. 1971 30 p refs
(NASA-TM-X-65471; X-550-71-20) Avail: NTIS CSCL 22A

A method is described in which the overall error or uncertainty involved in spacecraft trajectory determinations is used to define a time dependent error bound for the coordinates of the spacecraft. The differences obtained by comparing tracking data with theory reflect errors or uncertainties in the Hamiltonian of the system, and in turn form a type of Canonical ensemble considered in statistical physics. Such considerations then allows one to derive a set of virtual forces that account for the uncertainties in the Hamiltonian which give rise to the calculated differences from the true orbit. Author

N71-21065# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Mechanical Engineering.
ON-LINE PARAMETER UPDATING FOR MARS STRATOSPHERE AND TROPOSPHERE USING MINIMAL MEASUREMENTS
J. C. Duke and C. N. Shen 1970 36 p refs
(Contract DAAB07-69-C-0365)
(AD-717106) Avail: NTIS CSCL 3/2

A technique is developed for on-board computation of the Mars atmospheric parameters ahead of an entry vehicle based upon discrete measurements of density and temperature gradient utilizing a maximum likelihood sequential estimation scheme. An atmospheric model suitable for describing both adiabatic and isothermal atmospheric regions has been derived. A rapid estimation scheme is introduced which permits a rapid reevaluation of the covariance matrix of the atmospheric parameters when passing through a changing atmospheric environment. A parameter transition detection scheme is developed which is suitable for determining a region of atmospheric alteration which cannot be known prior to atmospheric entry. A digital computer evaluation demonstrates the rapid estimation scheme is clearly superior to standard Kalman filtering throughout both the stratosphere and troposphere. GRA

N71-21068# California Inst. of Tech., Pasadena. Kellogg Radiation Lab.
EXPERIMENTAL AND THEORETICAL INVESTIGATIONS OF LIGHT NUCLEI Final Report
Dec. 1970 127 p refs
(Contract Nonr-220(47))
(AD-717083) Avail: NTIS CSCL 3/2

Contents: Stellar reactions; Theoretical nuclear astrophysics (SINS); Relativistic astrophysics and cosmology; The weak interaction in nuclei; Gamma radiation; Nuclear reactions; Nuclear masses and nuclear reaction Q-values; Isospin as a nearly conserved quantum number in nuclei; Theory, Summary papers; Instrument development; Atomic physics; Application of nuclear techniques to solid state physics; Calibration of detectors for space research. GRA

N71-21191# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE UNCERTAINTY PRINCIPLE: A LIMITATION ON METEOR TRAIL RADAR WIND MEASUREMENTS
James D. Lindberg Oct. 1970 24 p refs
(AD-716996; ECOM-5337) Avail: NTIS CSCL 4/1

In any Doppler radar measurement of the drift velocity of a meteor trail, the duration of the trail limits the data collection to a time interval on the order of one second, and often less. It is shown that the corresponding limitation on measurement of frequency of the returned radar pulse, imposed by the uncertainty principle, is not trivial. For the frequencies commonly used, root mean square errors on the order of several meters per second should be expected. Author (GRA)

N71-21253 Georgetown Univ., Washington, D.C.
AN ANALYSIS OF THE LIGHT VARIATIONS OF THREE SHORT-PERIOD ECLIPSING BINARIES
Kenneth John Johnston (Ph.D. Thesis) 1970 145 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 70-6341

The light variations of UU Piscium, EM Cephei and 44 i Bootis were investigated. UU Piscium was monitored in the V Color. The amplitude of the light variation was 0.03 magnitude. This is caused by the elliptical shapes of the component stars of UU Piscium. The phase of secondary minimum occurred at 0.55. The cause of this may be that the period of rotation of the component stars of UU Piscium is not synchronized with their orbital revolution, or their orbit is elliptical. Previous observations of UU Piscium by N.L. Magalashvili and I.J. Kunsishvili seem to indicate that the orbit is elliptical but more observations are needed to confirm this. The variable star EM Cephei was found to have a period of 0.80627 days. There were many nights' data that did not agree with the mean light curve. Fluctuations in the period, caused by mass transfer between the component stars of EM Cephei, could account for the variations in the light curve. The variable star 44 i Bootis was observed in the H-Beta index. The period of this star has been found to be constant since 1960. The variation in the H-Beta index could be accounted for by mass transfer between the components of the binary system. Dissert. Abstr.

N71-21254 Virginia Polytechnic Inst., Blacksburg.
TRAJECTORY OPTIMIZATION BY TERMINAL IMBEDDING
Raymond Clifton Montgomery (Ph.D. Thesis) 1969 123 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 70-5361

Imbedding theory is applied to two problems in control theory. The first problem of interest is the synthesis of linear feedback control systems for the gains required to obtain specified pole-zero transfer function requirements. In this application the theory developed here is referred to as the method of conversion to differential form. The application of this method results in a set of ordinary differential equations which must be solved in order to derive the appropriate gains. The second problem to which imbedding theory has been applied is one of trajectory optimization. This application is referred to as terminal imbedding. It involves imbedding the trajectory optimization problem of interest in a family of problems which are parameterized by the terminal conditions. Using this concept necessary conditions are derived herein which are equivalent to the maximum principle for the imbedded set of problems. Dissert. Abstr.

N71-21314*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RETENTION AND APPLICATION OF SATURN EXPERIENCES TO FUTURE PROGRAMS
W. David Brown and Nancy Milly 8 Mar. 1971 210 p
(NASA-TM-X-64574) Avail: NTIS CSCL 22A

Significant unsatisfactory condition reports are presented. New inspection techniques, developed or refined during the Saturn program, are also identified. The experience and practical benefits of the Saturn program for dissemination and use on future programs are summarized. Three indices are provided for locating specific problems by hardware type, problem type, and physical condition. Author

N71-21325*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPARISON OF LUNAR GRAVITY FIELDS USING GSFC RANGE-RATE DATA FROM AIMP-E
Victor T. Laczo Nov. 1970 26 p refs
(NASA-TM-X-65470; X-552-70-409) Avail: NTIS CSCL 03C

Two consecutive three-day arcs of unsmoothed VHF Doppler tracking data were used to determine lunar orbits for AIMP-E (Explorer 35). This study yielded magnitudes for Doppler residuals and estimates for trajectory errors as a function of five lunar gravity models. To a certain extent this analysis permits evaluation of the GRARR System tracking a lunar orbiting satellite. An additional purpose of this report is to relate orbit prediction quality as a function of various lunar gravity models. The trajectory differences were best minimized by the Field 15 potential model which was derived from an analysis of orbital motion of Apollo 8. Author

N71-21326*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DYING STARS: NEUTRON STARS, BLACK HOLES, ETCETERA
Sachiko Tsuruta (Smithsonian Astrophys. Obs.) Feb. 1971 30 p refs Submitted for publication
(NASA-TM-X-65479; X-641-71-84) Avail: NTIS CSCL 03A

A theory for the evolution of dying stars, neutron stars and black holes is presented. Subjects discussed are: (1) the fate of a star, (2) properties of dense matter, (3) neutron stars and white dwarfs, and (4) detectability of dying stars. Author

N71-21327*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LUNISOLAR PERTURBATIONS OF THE MOTION OF ARTIFICIAL SATELLITES
David Fisher Jan. 1971 27 p refs
(NASA-TM-X-65476; X-552-71-60) Avail: NTIS CSCL 22C

An expression for the lunisolar disturbing function is given which provides the basis for the calculation of perturbations in the motion of artificial satellites. The Lagrange planetary equations are derived in a form suitable for satellites of arbitrary eccentricity in contrast to the standard form which depends upon first developing the disturbing function in powers of eccentricity. The spectrum of the disturbing function is partitioned into secular, long period, intermediate, and short period terms. The motion of the short period terms is dominated by the mean anomaly of the satellite. The remaining terms are derived by averaging the disturbing function over the satellite's mean anomaly. Those terms which contain the mean longitude of the sun or the moon are called terms of intermediate period. For the sun these terms have periods of multiples of 180 days, for the moon the corresponding periods are multiples of 14 days. Additional averaging over the mean anomaly of the disturbing body results in the secular and long period terms. Author

N71-21328 Colorado Univ., Boulder.
THERMONUCLEAR DETONATIONS IN COLLAPSING WHITE DWARF STARS
John Craig Wheeler (Ph.D. Thesis) 1969 184 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 70-5904

The possibility is investigated that the progenitors of Type I supernovae are white dwarf stars with mass near the Chandrasekhar limit which become dynamically unstable due to electron capture on Mg(24) in their central regions. Models of spherical, non-rotating, isothermal white dwarf stars of uniform composition are constructed in hydrostatic equilibrium. Magnetic fields and crystallization effects (except in the nuclear reaction rates) are neglected. A composition change which corresponds to electron capture on Mg(24) is then effected. The subsequent dynamic behavior of the models is studied with numerical hydrodynamics techniques. Dissert. Abstr.

N71-21338*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE PROGRAMS SUMMARY NO. 37-66, VOLUME 3 FOR THE PERIOD 1 OCTOBER–30 NOVEMBER 1970. SUPPORTING RESEARCH AND ADVANCED DEVELOPMENT
31 Dec. 1970 246 p refs
(Contract NAS7-100)
(NASA-CR-117440; JPS-SPS-37-66-Vol-3) Copyright. Avail: NTIS CSCL 22A

Theoretical and experimental research reported pertains to lunar exploration and interplanetary spacecraft missions. Main topics refer to the development of a Thermoelectric Outer Planet Spacecraft /TOPS/ for future flights to Jupiter and Saturn environments. For individual titles see: N71-21339 through N71-21359.

N71-21339*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
ADVANCED STUDIES: FUTURE PROJECTS
In its Space Programs Sum. No. 37-66, Vol. 3, Oct.–Nov. 1970 31 Dec. 1970 p 1–3 refs (See N71-21338 10-30)
Copyright. Avail: NTIS CSCL 03C

The various non-instrument corrections that are commonly applied to lunar grivity data in order to relate all observations to a common datum are considered. Anomalies in the gravity field of the moon are attributed to density contrasts in surface and subsurface rocks, to so-called terrain effects which lead to the free-air, Bouguer, and topographic corrections, and finally, shape effects. In order to use gravity data to interpret lunar structures and shapes, it is necessary to make corrections for terrain effects on the data. Author

N71-21340*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ENVIRONMENTAL REQUIREMENTS
In its Space Programs Sum. No. 37-66, Vol. 3, Oct.–Nov. 1970 31 Dec. 1970 p 4–9 refs (See N71-21338 10-30)
Copyright. Avail: NTIS CSCL 03C

The properties of the major condensable constituents, ammonia and water, in modeling amospheres of Jupiter and Saturn are considered. Empirical equations are formed that give partial vapor pressures over solid NH3, solid (NH3)2H20 hydrate, solid NH3H20 hydrate, solid H20, and NH3-H20 solution phases. Equations for freezing curve temperatures as a function of concentration are also given. Finally, a phase diagram is produced that displays equations graphically. G.G.

N71-21359*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING AND ORBIT DETERMINATION
In its Space Programs Sum. No. 37-66, Vol. 3, Oct. – Nov. 1970 31 Dec. 1970 p 233 – 235 refs (See N71-21338 10-30)
Copyright. Avail: NTIS CSCL 22A

The application of Kalman filters to spectral factorization in discrete systems is reported. The sequential filter is asymptotically stable if the system is uniformly observable and controllable; when the system is time-invariant, the error covariance converges to a constant matrix which is identical to the one obtained by the spectral factorization of the Wiener-Shannon theory. A steady state solution is provided for the tracking problem of a spacecraft moving along a straight line by means of the ranging system at the ground station. G.G.

N71-21407*# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.
APOLLO LUNAR SURFACE EXPERIMENTS PACKAGE. APOLLO 14 LASER RANGING RETRO-REFLECTOR EXPERIMENT (LRRR) Final Report
31 Oct. 1970 18 p refs
(Contract NAS9-5829)
(NASA-CR-114901; BSR-3040) Avail: NTIS CSCL 03B

The design, development, fabrication, and test of the Apollo 14 Laser Ranging Retroreflector experiment (LRRR) is discussed. Subjects presented are: (1) project milestones, (2) equipment specifications, (3) quality control measures, (4) thermal engineering, (5) structural and dynamic analysis, and (6) human factors engineering. Author

N71-21435*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SCIENTIFIC EXPERIMENTS FOR A MANNED MARS MISSION
Hugh J. Dudley, James K. Harrison, James O. Ballance, Milton A. Page, Joseph R. Dabbs et al Washington Mar. 1971 64 p refs
(NASA-TM-X-2127; M-900) Avail: NTIS CSCL 22A

Scientific experiments for an assumed first manned mission to Mars are discussed. Experiments have been established in the following scientific disciplines: (1) planetary atmospheres, (2) planetary surfaces, (3) planetary dynamics and interiors, (4) particles and fields and planetary interactions with the solar wind, and (5) exobiology. The emphasis throughout the report is on a detailed program of experiments as opposed to a broad and general outline. Instruments needed for the experiments have been described and tabulated. Briefly discussed are requirements for certain operational aspects of the mission, such as crew size, surface rovers, unmanned orbiters, scientific laboratories, and landing sites. Author

N71-21462*# Yale Univ., New Haven, Conn. Dept. of Geology and Geophysics.
ANALYSES OF APOLLO 11 AND 12 ROCKS AND SOILS BY NEUTRON ACTIVATION
C. P. Kharkar and K. K. Turekian 1971 12 p refs
(Contract NAS9-8032)
(NASA-CR-114926) Avail: NTIS CSCL 03C

New analyses of Apollo 11 and 12 rocks made by instrumental neutron activation analysis for Na, Mn, Dy, Sm, Lu, La, Yb, Ce, Eu, Tb, Sc, Hf, Cr, Co, Fe, Ti, and Ta, and by X-ray fluoresxence for Ca, together with radiochemical results for Au, Ag, and Mo and fission track U determinations for Apollo 12 rocks are reported. The excess of Au and Ag in soil relative to rocks reported previously is confirmed and contamination of a Lunar Receiving Laboratory processed rock for Au, Ag, and Mo clearly is indicated. Author

N71-21464*# Chicago Univ., Ill. Enrico Fermi Inst.
OXYGEN ISOTOPE FRACTIONATION IN APOLLO 12 ROCKS AND SOILS
Robert N. Clayton, Naoki Onuma, and Toshiko K. Mayeda [1971] 18 p refs
(Contract NAS9-7888)
(NASA-CR-114925) Avail: NTIS CSCL 03C

Oxygen isotopic compositions of individual minerals and isotopic fractionations between coexisting minerals are remarkably similar for Apollo 11 and 12 crystalline rocks. Apollo 12 rocks show a somewhat lower plagioclase-ilmenite isotopic temperature of 1070 C, related to the late crystallization of ilmenite in these rocks. Author

N71-21486*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
APOLLO LASER RANGING RETRO-REFLECTOR EXPERIMENT (SO78) Final Report
C. O. Alley Feb. 1971 305 p refs
(Contract NAS9-7809)
(NASA-CR-114951) Avail: NTIS HC$6.00/MF$0.95 CSCL 20E

The research and development of the Apollo Laser Ranging Retro-Reflectors (LRRR) is discussed. The place of this activity in the overall development of the Apollo Lunar Laser Ranging Experiment is also briefly presented. The performance of the LRRR's in the lunar environment can only be assessed through the ground instrumentation part of the experiment. The performance of the Apollo 11 and Apollo 14 LRRR's is entirely satisfactory and seems to be in accordance with the design parameters within the limits of the ability to measure their reflectivity. Author

N71-21515 National Lending Library for Science and Technology, Boston Spa (England).
ON THE COMPARISON OF THE THEORETICAL AND OBSERVED REFLECTION COEFFICIENTS FOR THE CLOSE BINARY SYSTEMS [K VOPROSU O SRAVNENII TEORETISCHESKOGO KOEFFITSIENTA OTRAZHENIYA S NABLYNDENIYAMI DLYA TESNYKH DVOYNYKH SISTEM]
M. E. Kiperman Sep. 1970 2 p refs Transl. into ENGLISH from Astron. Tsirk. (USSR), v. 456 p 6 – 7
(NLL-RTS-6000) Avail: Natl. Lending Library, Boston Spa, Engl.: 4s; 1 NLL photocopy coupon

Theoretical reflection coefficient values for the spectral class BO-AO (Group H) were recalculated from Hosokawa's data. Monochromatic flux values used agreed with accurate stellar atmosphere models of spectral classes and a refined temperature scale for hot stars. Data on theoretical and measured reflection coefficient deviations are tabulated. E.C.

N71-21575*# Geological Survey, Denver, Colo.
B.3 MASS SPECTROSCOPY DETERMINATION FOR U, Th, AND Pb CONCENTRATIONS AND Pb, U, AND Th ISOTOPE ABUNDANCES Final Report
Mitsunobu Tatsumoto Mar 1971 82 p refs
(NASA Order T-75445)
(NASA-CR-114959) Avail: NTIS CSCL 03C

The mass spectroscopy of lunar samples to determine lunar evolution is discussed. The following results are reported: (1) the uranium-thorium-lead system on rocks collected by Apollo 11 and

12 confirm the antiquity of the moon, (2) the lunar soils were derived from source material about 4650 million years old, and (3) the large ratios of uranium to lead and thorium to lead and the uranium-thorium-lead systematics of the lunar samples suggest that the moon was accreted from the broiled outer particles in the proto-earth-moon system. Author

N71-21599*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ANALYTICAL STUDIES OF LUNI-SOLAR EFFECTS ON THE MOTION OF ARTIFICIAL SATELLITES

Theodore L. Felsentreger and James P. Murphy Mar. 1971 24 p refs

(NASA-TM-X-65485; X-552-71-111) Avail: NTIS CSCL 22A

Theoretical and experimental studies indicate that long periodic lunar and solar forces produce perturbations in the orbital elements of some close earth satellites which are comparable to long period geopotential zonal harmonic effects. Analytical formulations for third body, solar radiation pressure, tidal, and precession and nutation effects have been successfully used to account for observable long period variations in the orbital elements of such satellites as Relay 1, Relay 2, and Telstar 2. Remaining variations in some oribtal elements (after removal of the luni-solar, etc. effects) provide strong evidence for adjustment of geopotential parameters (used in the orbit determinations) to more recent values. Preliminary attempts to deduce seasonal variations in the geopotential have been promising. An analysis of the long period variations remaining in the orbital elements of satellites after removal of all zonal harmonic, luni-solar gravitation, solar radiation pressure, tidal, and precession and nutation effects is presented. Author

N71-21720*+ National Aeronautics and Space Administration, Washington, D.C.

APOLLO 14: SCIENCE AT FRA MAURO

GPO 1971 49 p Original contains color illustrations

(NASA-EP-91) Avail: SOD $1.25; NTIS CSCL 22C

A narrative of the Apollo 14 flight is presented with color pictures obtained by the astronauts. F.O.S.

N71-21727# General Electric Co., Philadelphia, Pa. Missile and Space Div.

PROGRESS AND GOALS FOR AERONAUTICAL APPLICATIONS OF SPACE TECHNOLOGY

Daniel J. Fink and Roy E. Anderson [1970] 9 p Presented at EUROSPACE (4th US-European Conf.), Venice, 25 Sep. 1970

(PIB-A-57) Avail: Issuing Activity

Current and projected technological applications are briefly described, using VHF satellite communication as an example. Ranging experiments with ATS 1 and ATS 3 satellites are explained and illustrated with lattitude determinations of Gander, Newfoundland, and position fixing for an aircraft over the North Atlantic. The quality of voice communication is compared for HF with no satellite link, ground to ground with ATS 3 satellite link, aircraft to ground via ATS 3 link, and ship to land with ATS 3 link. It is recommended that a comparison should be made of the performances of HF and VHF for transoceanic communications, the VHF satellite performance should be weighed against cost, and the L-band technology should be developed. N.E.N.

N71-21773 National Lending Library for Science and Technology, Boston Spa (England).

THE INVESTIGATION OF ABSORPTION IN A REGION OF THE MILKY WAY WITH THE CENTRE ALPHA = 20h 16m, DELTA = + 42 DEG 30 MIN [ISSLEDOVANIE POGLOSHCHENIYA V POLSHCHADKE MLECHNOGO PUTI S TSENTROM ALPHA = 20h 16m, DELTA = + 42 DEG 30 MIN]

R. N. Ikhsanov Sep. 1970 10 p refs Transl. into ENGLISH from Izv. Krym. Astrofiz. Observ. (USSR), v. 21, 1959 p 257–267

(NLL-RTS-6051) Avail: Natl. Lending Library, Boston Spa, Engl.: 20s; 3 NLL photocopy coupons

The normal colors of O, B, A type stars were determined in the Crimean system of color indices. The necessity of taking into account ultraviolet radiation less than wavelength 3800 A is shown. The red absolute stellar magnitudes M sub r were calculated. The data of the star catalog were used for studying the selective absorption in a region of the Milky Way in Cygnus. Eight areas, all with about the same character of absorption, were singled out. Author

N71-21774 National Lending Library for Science and Technology, Boston Spa (England).

ON THE RELATION BETWEEN THE EXCESS OF LUMINOSITY OF THE SECONDARY COMPONENT AND MASS RATIO OF THE STARS IN ECLIPSING VARIABLES WITH SUBGIANTS [O ZAVISIMOSTI MEZHDU IZBYTKOM SVETIMOSTI SPUTNIKA I OTNOSHENIEM MASS ZVEZD V ZAT MENNYKH PEREMENNYKH SISTEMAKH S SUBGIGAN TAMI]

M. V. Popov Sep. 1970 4 p refs Transl. into ENGLISH from Astron. Tsirk. (USSR), v. 460, 1968 p 4–6

(NLL-RTS-5999) Avail: Natl. Lending Library, Boston Spa, Engl.: 8s; 1 NLL photocopy coupon

The term eclipsing variable systems with subgiants is taken as meaning systems in which a less massive star has a large radius and its luminosity is excessive for the given mass; the more massive star is a main sequence star. The existence of a relationship between the excess of luminosity of the subgiant and the mass ratio is considered. In order to plot the relationship for 69 systems with subgiants, their absolute dimensions are determined from the elements of photometric and spectral orbits. It is found that the excess of luminosity of the subgiant increases with reduction of the mass ratio. Author

N71-21775 National Lending Library for Science and Technology, Boston Spa (England).

THE SPECTRA, MAGNITUDES AND COLOURS OF O-A TYPE STARS IN AN AREA OF THE MILKY WAY WITH THE CENTRE ALPHA = 20h 16m, DELTA = + 42 DEG 30 MIN [SPEKTRY, VELICHINY I TSVETA O-A ZVEZD V PLOSHCHADKE MLECHNOGO PUTI S TSENTROM ALPHA = 20h 16m, DELTA = + 42 DEG 16 MIN]

R. N. Ikhsanov Sep. 1970 30 p refs Transl. into ENGLISH from Izv. Krym. Astrofiz. Observ. (USSR), v. 21, 1959 p 229–256

(NLL-RTS-6050) Avail: Natl. Lending Library, Boston Spa, Engl.: 60s; 10 NLL photocopy coupons

A catalog of the stars of class O-A approximately down to 12.5 photographic magnitude is reported for a zone of 6 deg diameter with center alpha = 20 h 16m, delta = +42 minutes 30 seconds (constellation Cygnus). The catalog contains the spectral classes, photographic magnitudes and colors of 952 stars. Author

N71-21777# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

VENUS REVEALS ITS SECRETS [VENERA RASKRYVAET TAINY]

27 Oct. 1970 81 p Transl. into ENGLISH from the Russian

(AD-717013; FTD-MT-24-155-70) Avail: NTIS CSCL 3/2

The book tells about the next stage of the Soviet program for the investigation of the planet Venus with the aid of the automatic space stations, Venus-5 and Venus-6. The reader can follow the whole history of mans investigations of Venus, beginning with the most ancient times and continuing up to the present. He will become acquainted with the flights of the space stations Venus-1, Venus 2, Venus-3 and Venus-4, which helped to reveal

certain mysteries of the planet and simultaneously defined more accurately the possibilities of subsequent investigations. In the flights of the space stations Venus-5 and Venus-6 data were received about the atmosphere of Venus and the characteristics of interplanetary space, which enriched mans knowledge of the universe. Author (GRA)

N71-21801# Rice Univ., Houston, Tex. Aero-Astronautics Group.
USE OF THE METHOD OF PARTICULAR SOLUTIONS IN DETERMINING PERIODIC ORBITS OF THE EARTH-MOON SYSTEM
Klaus Hinrich Well Dec. 1970 23 p refs
(Grant AF-AFOSR-0828-67)
(AD-717192; AAR-81; AFOSR-70-2918TR) Avail: NTIS CSCL 3/3

Modified quasilinearization is employed in combination with the method of particular solutions in order to find several periodic orbits of the Earth-Moon system, specifically, (a) an orbit around the Earth, (b) an orbit around the Moon, and (c) an orbit around both the Earth and the Moon. The computational results show that convergence is quite rapid, even though each nominal curve employed is not a good approximation to the solution. Author (GRA)

N71-21802# Calif. Inst. of Tech., Pasadena, Calif. Owens Valley Radio Observatory.
A METHOD FOR ANALYSING DRIFTING RANDOM PATTERNS IN ASTRONOMY AND GEOPHYSICS. THE MOTION OF THE SOLAR WIND CLOSE TO THE SUN
L. T. Little and R. D. Ekers 1970 42 p refs
(Contract N00014-67-A-0094-0008)
(AD-716735; Rept-1970-12) Avail: NTIS CSCL 3/2

The motion of interplanetary irregularities is derived in the range of solar elongation 6-40 solar radii from observations of interplanetary scintillation using spaced receivers at the Goldstone Deep Space Tracking Station, California. The acceleration of the irregularities is found to be consistent with that predicted for a Parker solar wind model having a coronal temperature of about 1,000,000 degrees K. There is evidence for high turbulent velocities of the irregularities which persist out to about 30 solar radii and which account for the high frequency tails in the scintillation spectra observed by other workers. Author (GRA)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N71-20667# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SATELLITE FOR SOLAR RESEARCH [SPUTNIK DLYA ISSLEDOVANIYA SOLNTSA]
29 Oct. 1970 9 p Transl. into ENGLISH from the Russian
(AD-717017; FTD-HT-23-706-70) Avail: NTIS CSCL 22/2

This pamphlet was prepared for distribution at the permanent Exhibition of Achievements of the National Economy (Moscow). It discusses the need for research on various types of solar emissions and lists the equipment and functions of the Kosmos-166 and Kosmos-230 solar research satellites. Orbital parameters of the satelites are given. GRA

N71-20716# European Space Research and Technology Center, Noordwijk (Netherlands). Space Science Dept.
ESRO SATELLITE RESULTS IN POLAR REGIONS
D. E. Page 1970 26 p refs Presented at the 21st Intern. Astronautical Congr., Constance, West Ger., 4–10 Oct. 1970
Avail: NTIS

The experiments carried on the four ESRO satellites so far launched have concentrated almost entirely on studies of the magnetic and electric field environment of the planet earth and of those particles with energies which can be controlled or at least modulated by these fields. ESRO 2/Iris (launched May 1968), ESRO 1/Aurorae (October 1968) and ESRO 1B/Boreas (October 1969) were all in near earth orbits and studied mainly auroral phenomena, the radiation belts and the arrival of solar particles over the polar caps. HESO 1 (December 1968) went to 40 earth radii and included measurements of solar wind parameters and interplanetary magnetic field as well as the barium cloud electric field experiment carried out at 10 earth radii. The missions and satellite payloads are summarized but the main emphasis is given to particle measurements made over the polar caps and in the auroral zone. It is now clear that the precipitation pattern of solar particles over the polar cap is a very complex one and is closely related to the position of the boundary of the trapped radiation belt particles. Studies of these features give further information on the magnetic field structure surrounding the planet earth. Author (ESRO)

N71-20767# European Space Research and Technology Center, Noordwijk (Netherlands).
AURORAE STATUS REPORT AFTER SIX MONTHS IN ORBIT
P. J. Caseley, ed. Jan. 1970 52 p refs
(ESRO-TN-100(ESTEC)) Avail: NTIS

The spacecraft ESRO-1 was launched from Vandenberg Air Force Base, California, by a Scout solid-fuel rocket at 20 h 49 m GMT (13 h 49 m Pacific Daylight Time) on 3rd October 1968. On achieving orbital status, the new satellite received the name Aurorae. A survey of the behavior of all spacecraft systems during the first six months of Aurorae's life is made. Scientific results are not included here; they will be reported on elsewhere by the experimentors. Author (ESRO)

N71-20783# France Cables Sousmarine et de Radio, Paris.
THE SYMPHONIE PROJECT AND ITS APPLICATION
R. Sueur 1970 15 p Presented at the 4th EUROSPACE US-European Conf., Venice, 22–25 Sep. 1970
Avail: NTIS

The German-French Symphonie communication satellite configurations, operational problems, orbit, launcher, ground stations, test program, and applications are reviewed. ESRO

N71-20788# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Inst. fuer Stratosphaerenphysik.
ADDITIONAL ROCKET PROGRAM FOR THE SATELLITE PROJECT AZUR, PROJECT SPAZ. PART 3: DESCRIPTION OF THE PCM TELEMETRY SYSTEM AND OF PERIPHERAL UNITS ASSIGNED TO SPECIFIC EXPERIMENTS [DAS ZUSATZRAKETENPROGRAMM ZUM SATELLITENPROJEKT AZUR, PROJEKT SPAZ. TEIL 3: BESCHREIBUNG DES PCM-TELEMETRIESYSTEMS UND DER EXPERIMENTSPEZIFISCHEN PERIPHERIE-EINHEITEN]
E. Keppler Bad Godesberg, West Ger., Bundesmin. fuer Bildung und Wiss. Dec. 1970 130 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-70-69) Avail: NTIS; ZLDI Munich: 26.90 DM

A PCM-telemetry system for rocket applications is described. The system provides for a bitrate of 80 kbit/sec. Special subsystems (A/D-converters, pulse height analyzers etc.) have been developed to complete the system for a specific rocket program. These are integrated into the telemetry system. Author (ESRO)

N71-20789# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Unternehmensbereich Raumfahrt.
ADDITIONAL ROCKET PROGRAM FOR THE SATELLITE PROJECT AZUR-625/A1, PROJECT SPAZ. PART 2: INTEGRATION AND FLIGHT PERFORMANCE [ZUSATZRAKETENPROGRAMM ZUM SATELLITENPROJEKT AZUR-625/A1, PROJEKT SPAZ. TEIL 2: INTEGRATIONS- UND FLUGBERICHT]
K. Bunk, C. Jeanclaude, A. Kirchner, and A. Scheuplein Bad Godesberg, West Ger., Bundesmin. fuer Bildung und Wiss. Nov. 1970 157 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-70-60) Avail: NTIS; ZLDI Munich: 30.25 DM

The technical design and development of five payloads to be flown with Black Brant V A rockets are described. Test results obtained during functional and environmental tests with these payloads are shown. The performance of the rockets is demonstrated by the housekeeping data obtained during flight. Author (ESRO)

N71-20810# Lockheed Missiles and Space Co., Sunnyvale, Calif.
BUILDING TOGETHER: TRUE SPACE TRANSPORTATION
Reginald R. Kearton 1970 13 p Presented at the 4th EUROSPACE US-European Conf., Venice, 22–25 Sep. 1970
Avail: NTIS

The advantages of the space shuttle such as low cost space transportation are emphasized. The following applications are tested: (1) the use of chemical and nuclear powered shuttle launched stages to carry payloads to synchronous orbits, the moon, and the planets; (2) the use of shuttle launched spacecraft; (3) manned experiments aboard or launched from the shuttle, and (4) point to point commercial transportation on earth. ESRO

N71-20928# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
GRAVITY-GRADIENT STABILIZATION STUDIES WITH THE DODGE SATELLITE
Robert E. Fischell and Frederick F. Mobley Apr. 1970 50 p refs
(Contract NOw-62-0604-C)
(AD-716772; APL-TG-1112) Avail: NTIS CSCL 22/3

The DODGE satellite was launched on 1 July 1967 into a near-synchronous orbit to demonstrate gravity-gradient stabilization at that high altitude and to experiment with various design parameters and damping techniques. This satellite was the first to be three-axis stabilized at high altitude using gravity-gradient techniques. It continues to function satisfactorily to the present date. Stabilization in pitch and roll to better than plus or minus 10 degrees has been obtained. The yaw stabilization of plus or minus 45 degrees has been fairly consistent; with the assistance of a small angular momentum flywheel, yaw accuracy of plus or minus 20 degrees was achieved. Magnetic damping of the sample-and-hold type and simulated hysteresis were both successful in damping librations. Efforts with the torsion-wire-suspended damper boom scheme were not successful, probably because of a mechanical bias in the device. A television camera system permitted observation of the boom bending under the influence of solar heating. Mechanical hysteresis in the boom bending was observed. Author (GRA)

N71-20976*# McDonnell Douglas Astronautics Co., Huntington Beach, Calif.
MAINTENANCE AND REPAIR REQUIREMENTS
M. S. Bonura *In* NASA. Langley Res. Center Prelim. Results from an Operational 90-Day Manned Test of a Regenerative Life Support System 1971 p 313–322 (See N71-20951 10-05)
Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

A primary mission objective of the space station simulator 90-day manned test was that all spares would be stored onboard with all required maintenance and repair tasks performed by the crewmen. This mission objective was met since all maintenance and repairs were accomplished utilizing only onboard spares. During the test, the crew performed 212 maintenance and repair tasks on the life support system (LSS) and over 40 maintenance and repair tasks on miscellaneous support equipment. All LSS units were successfully repaired with the exception of the zero-g urine collector and the onboard electrolysis unit. These units were shut down on days 6 and 20, respectively, when the onboard repair efforts could not restore operation. The test was completed using backup procedures and equipment for these functions. Author

N71-21064* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE APPENDAGE TIE DOWN CORD Patent
Elmer W. Travis and Jesse M. Madey, inventors (to NASA) Issued 31 Oct. 1967 (Filed 23 Oct. 1965) 5 p Cl. 244-1
(NASA-Case-XGS-02554; US-Patent-3,350,034; US-Patent-Appl-SN-504266) Avail: US Patent Office CSCL 22B

A securing mechanism for satellite appendages is described consisting of an elastic nylon cord within a slightly longer fiberglass covering. The cable is designed to fasten satellite booms, solar paddles, etc. to the surface or face of the last stage of a rocket booster during launch and the initial flight of satellite, and to provide a means for release at some time after the satellite has left the atmosphere of the earth. The cable is constructed to absorb rocket booster expansion and is designed with fail-safe features to withstand abnormally high temperatures or pressure conditions. D.L.G.

N71-21181# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE SPACE STATION PROTON-4
23 Oct. 1970 11 p Transl. into ENGLISH from the Russian
(AD-717066; FTD-HT-23-704-70) Avail: NTIS CSCL 22/2

The weight, equipment, parameters, and mission of the satellite Proton-4 are discussed. The pamphlet was intended for distribution at an exhibition. GRA

N71-21317*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE SHUTTLE WITH EXTERNAL HYDROGEN DROP TANKS
Herman E. Thomason 1 Oct. 1970 35 p
(NASA-TM-X-64579) Avail: NTIS CSCL 22B

The guidelines and study results of an investigation into the fully-reusable space shuttle configuration to determine the effect of carrying the ascent liquid hydrogen (LH2) propellant in external tanks are given. The concept chosen for comparison carried 100 percent of the ascent LH2 in external tanks; after the orbiter is inserted into the transfer orbit, the tanks are separated from the vehicle. The concept allows extensive use of heat sink materials on the Booster, rather than thermal protection materials. Weight and cost differences from the base line vehicle are evaluated by a normalization procedure which includes a set of weight scaling equations, vehicle sizing programs, and cost estimating relations. Results indicate that for the low cross range configuration a reduction in vehicle gross lift-off weight (GLOW) of 362,874 kg (800,000 lb) can be achieved with a program cost savings of approximately $0.6 billion, whereas the high cross range configuration shows a 680,389-kg (1,500,000-lb) reduction in GLOW, with a $1 billion program cost saving. The RD&TE cost reduction would be on the order of $1.4 billion with reductions in the peak and early program years' funding. Author

N71-21324# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE SPACESHIP VOSTOK [KOSMICHESKII KORABL

VOSTOK]
29 Oct. 1970 11 p Transl. into ENGLISH from the Russian
(AD-717082; FTD-HT-23-705-70) Avail: NTIS CSCL 22/2

This pamphlet was prepared for distribution at the permanent Exhibition of Achievements of the National Economy (Moscow). The general arrangement of the spaceship, the lander, and the on-board systems is outlined and general information on the life support system is given. Two landing modes are discussed briefly.
GRA

N71-21452*# North American Rockwell Corp., Seal Beach Calif. Space Div.
PRE-PHASE A STUDY FOR AN ANALYSIS OF A REUSABLE SPACE TUG. VOLUME 1: MANAGEMENT SUMMARY Final Report
22 Mar. 1971 27 p
(Contract NAS9-10925)
(NASA-CR-114937; SD-71-292-1-Vol-1) Avail: NTIS CSCL 22B

A management summary is presented of the results of the pre-phase A study for an analysis of a reusable space tug. Provided is an identification of the space tug mission and design requirements and the feasibility of a single modular spacecraft concept for accomplishing the large spectrum candidate missions.
Author

N71-21453*# North American Rockwell Corp., Seal Beach, Calif. Space Div.
PRE-PHASE A STUDY FOR AN ANALYSIS OF A REUSABLE SPACE TUG. VOLUME 2: TECHNICAL SUMMARY Final Report
22 Mar. 1971 110 p
(Contract NAS9-10925)
(NASA-CR-114936; SD-71-292-2-Vol-2) Avail: NTIS CSCL 22B

Technology implications are used to determine the feasibility of a modular space tug design to effectively accomplish a broad spectrum of integrated program plan missions. Also determined are space tug mission interfaces, operational modes and system requirements, and hardware interfaces. It is concluded that a multipurpose space tug is economically feasible for application to both high and low performance earth orbital missions and that the earth orbital shuttle is the key interfacing system for the space tug.
G.G.

N71-21454*# North American Rockwell Corp., Seal Beach, Calif. Space Div.
PRE-PHASE A STUDY FOR AN ANALYSIS OF A REUSABLE SPACE TUG. VOLUME 3: MISSION AND OPERATIONS ANALYSIS Final Report
R. J. Milliken and G. M. Hanley 22 Mar. 1971 1090 p
(Contract NAS9-10925)
(NASA-CR-114935; SD-71-292-3-Vol-3) Avail: NTIS HC (Individually Priced)/MF $0.95 CSCL 22B

A mission model for the space tug was constructed and used to select design reference missions. Multipurpose space tug approaches were reviewed and operational mission analyses were performed. A revised mission model was used in tug conceptual design evaluations and economic studies were carried out for cost and resources optimization by computer analyses. Results were used to specify mission design requirements of three tug concepts selected for detailed studies.
Author

N71-21455*# North American Rockwell Corp., Seal Beach, Calif. Space Div.
PRE-PHASE A STUDY FOR AN ANALYSIS OF A REUSABLE SPACE TUG. VOLUME 4: SPACECRAFT CONCEPTS AND SYSTEMS DESIGN Final Report
22 Mar. 1971 646 p
(Contract NAS9-10925)
(NASA-CR-114938; SD-71-292-4-Vol-4) Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

Spacecraft configuration concepts of various diameters, propulsion capacities, modular arrangements, and mission modes were studied and compared. Resulting conceptual designs were utilized in weights, performance, operations, costs, and planning studies. Module configurations, internal and external, were explored. Conceptual vehicles were described, including suitable subsystems. The reusable space-based tug with modular design was found to be feasible as a design concept. The design is very sensitive to inert weights. The changes necessary for satisfying the requirements of a lunar lander were found to be extensive, and provisions for them in the basic tub would constitute excessive weight. Therefore, the lunar lander version of the tug should be considered a block change.
Author

N71-21456*# North American Rockwell Corp., Seal Beach, Calif. Space Div.
PRE-PHASE A STUDY FOR AN ANALYSIS OF A REUSABLE SPACE TUG. VOLUME 5: SUBSYSTEMS Final Report
22 Mar. 1971 488 p refs
(Contract NAS9-10925)
(NASA-CR-114939; SD-71-292-5-Vol-5) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

Trade studies were conducted to select feasible approaches and to define operational and performance requirements for reusable space tug subsystems. Areas included environmental control and life support, active thermal control, guidance and navigation, communications and data management, electrical power, and auxiliary control propulsion. A baseline set of subsystems was established and included the description of selected equipment for inclusion in intelligence, propulsion, and crew modules. Of primary emphasis were the feasibilities of the concepts of reusability, multimission capability, space-basing, and autonomy from excessive external support.
Author

N71-21457*# North American Rockwell Corp., Seal Beach, Calif. Space Div.
PRE-PHASE A STUDY FOR AN ANALYSIS OF A REUSABLE SPACE TUG. VOLUME 6: PLANNING DOCUMENTS Final Report
22 Mar. 1971 172 p
(Contract NAS9-10925)
(NASA-CR-114940; SD-71-292-6-Vol-6) Avail: NTIS CSCL 22B

The planning documents describe a logical, integrated set of activities and events necessary to accomplish mission and operational requirements of the reusable space tug. They include realistic schedules and cost estimates for budgetary and planning purposes and essential related program information for economical and high-quality development and operations. Also covered are preliminary analysis, definition, design, manufacture, test, ground operations, flight operations, refurbishment, and relative activities for the reusable space tug. The three major study development categories (unmanned earth-orbital tug, manned earth-orbital, and manned lunar tug) and the three selected design concepts are included.
Author

N71-21520# Arbeitsgemeinschaft fuer Forschung des Landes Nordrhein-Westfalen (West Germany).
EUROPEAN SCIENTIFIC AND COMMUNICATION SATELLITE TECHNOLOGY (RESEARCH WORKING GROUP FOR THE STATE OF NORDRHEIN-WESTFALEN)
1969 87 p refs In GERMAN; ENGLISH summary Presented at the Proc. of the 175th Meeting of the Arbeitsgemeinschaft fuer Forschung des Landes Nordrhein-Westfalen, Duesseldorf, 4 Dec. 1968 /its Heft 189
Copyright. Avail: NTIS; Westdeut. Verlag, Koeln und Opladen

Conference papers are presented for the following projects:

(1) high altitude simulation tests of the third state of Europa 1 launch vehicle; (2) design and requirements of the German research satellite Azur, and the German-French experimental communications satellite Symphonie; and (3) conception and design of a German ground station system for radio communications with artificial satellites. D.L.G.

N71-21556*# General Electric Co., Philadelphia, Pa. Space Div.
DESIGN AND USE OF SPACE STATION EXPERIMENT MODULES
D. J. Fink and R. A. Passman 1970 9 p Presented at the 21st Intern. Astronaut. Congr., Konstanz, West Germany, 10 Oct. 1970 Sponsored by NASA
(NASA-CR-117499) Avail: NTIS CSCL 22B

Operating mode selection for candidate earth-orbiting experiments is reviewed along with the methodology of the experiment module design approach. Examples of a cosmic ray laboratory, earth survey module, space processing laboratory, and an information management subsystem are described. Possibilities for international cooperation are mentioned. The recommended approach for space station experiment modules will use a common 14-foot diameter structural element in multiple lengths of 16, 32, or 48 feet. E.C.

N71-21654*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
RESISTOJET SYSTEMS STUDIES DIRECTED TO THE SPACE STATION/SPACE BASE Summary Report
R. V. Greco Apr. 1971 63 p
(Contract NAS1-10127)
(NASA-CR-111878; MDC-G2125) Avail: NTIS CSCL 22B

A prototype biowaste resistojet system was developed. The orbit-keeping and control moment gyro (CMG) desaturation requirements for the primary vehicle orientations and applicable altitude ranges were finalized. The environmental control/life support (EC/LS) biowaste outputs and the effects of food wetness and cabin leakage on these outputs were evaluated to define the biowaste propellants and the quantities available. The biowaste resistojet performance and power goals, using propellants singly and in combination, were assessed for both contemporary and advanced concepts. The resupplied propellants were compared to identify the supplemental propellant for excessive CMG desaturation requirements, maximum solar density years, and off-nominal crew size. A biowaste resistojet system was defined with the thrust level, duty cycle, and operating modes necessary to furnish the required propulsive functions and dispose of otherwise useless biowastes. Author

N71-21655*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
RESISTOJET SYSTEMS STUDIES DIRECTED TO THE SPACE STATION/SPACE BASE. VOLUME 1: STATION/BASE BIOWASTE RESISTOJET SYSTEM DESIGN Final Report
R. V. Greco and J. R. Bliss Apr. 1971 250 p refs
(Contract NAS1-10127)
(NASA-CR-111879; MDC-G2125-Vol-1) Avail: NTIS CSCL 22B

The resistojet system design concept, including results of the major trade studies, is summarized. The analyses conducted to determine propellant availability, supplemental propellant selection, propellant performance goals and usage modes, and impulse requirements are presented. The selected space station system and its design details are also presented, including detail assembly descriptions, system operation and operating modes, instrumentation requirements and system effectiveness analyses (reliability, maintainability, and fault isolation). The space base resistojet system is described and the similarities and differences between the station and base are given. Author

N71-21656*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
RESISTOJET SYSTEMS STUDIES DIRECTED TO THE SPACE STATION/SPACE BASE. VOLUME 2: BIOWASTE RESISTOJET SYSTEM DEVELOPMENT PROGRAM Final Report
R. V. Greco and J. T. Abe Apr. 1971 136 p refs
(Contract NAS1-10127)
(NASA-CR-111880; MDC-G2125-Vol-2) Avail: NTIS CSCL 22B

A system development program was defined as a prerequisite to the selection of a biowaste resistojet system for the space station and base. The approach consists of design, development, and test efforts required to achieve program objectives, defined as follows: (1) develop flight-weight prototype of biowaste resistojet components and assemblies with emphasis on components requiring advanced technology; (2) demonstrate performance and operating life characteristics of prototype components in a simulated resistojet system; and (3) demonstrate performance, operating life, and maintainability of an integrated EC/LS-resistojet system by a systems test. Author

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N71-20636# Columbia Univ., New York. Dept. of Civil Engineering and Engineering Mechanics.
NONLINEAR FORCED VIBRATIONS OF INFINITELY LONG CYLINDRICAL SHELLS
Hans H. Bleich and Jerry H. Ginsberg Nov. 1970 143 p refs
(Contract Nonr-266(86))
(AD-716795; TR-46) Avail: NTIS CSCL 20/11

Large amplitude forced vibrations of infinitely long, thin cylindrical shells are determined, using generalized coordinates which are the infinie sequence of normal modes of linear shell theory. The perturbation procedure employed gives solutions consisting only of a finite number of terms, so that arbitrary truncation of the infinite series in terms of the modes is avoided. As reported previously, unusual types of response are possible, in which the nodal lines of the applied sinusoidal pressure (in space) and of the radial displacement do not agree. Amplitude-frequency relations for regular and unusual responses are obtained. Numerical coefficients occurring in these relations are tabulated. It is demonstrated that the unusual responses exist only for sufficiently small values of a nondimensional parameter which increases with the ratio of critical damping. The unusual solutions become unstable, or do not exist, when the parameter exceeds cut-off values derived in the text. The situation is illustrated by a sequence of examples with varying values of damping. Author (GRA)

N71-20665 National Physical Lab., Teddington (England). Div. of Numerical and Applied Mathematics.
A CONTINUUM THEORY FOR COMPOSITE ELASTIC MATERIALS
A. F. Johnson Dec. 1970 29 p refs
(NPL-Ma-92) Copyright. Avail: Issuing Activity

A continuum theory is proposed for the mechanical behavior of elastic composites. The theoretical background is developed and equations are derived to determine the static and dynamic response of both long and short fiber composites. An indication of the scope of the theory is given with a review of further work to be done. Author (ESRO)

N71-20687# Louvain Univ. (Belgium). Inst. of Mechanical Engineering.

CALCULATION OF STATIC AND DYNAMIC CHARACTERISTICS OF AXIAL STRUCTURES BY COMPUTER TECHNIQUES

Luk Van den Noortgate (Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal.) Brussels Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal. May 1970 82 p refs Sponsored jointly by Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal. and Inst. pour l'Encour. de la Rech. Sci. dans l'Ind. et l'Agr.

(CRIF-MC-32) Avail: NTIS

Two computer programs are described for calculation of axial structures, i.e. structures with a straight axis, such as beams and axles. The first program allows the calculation of the static deflection due to an external load as well as natural frequencies and modes. In the second program damping is taken into account, so that dynamic deflection may also be determined. ESRO

N71-20701*# Drexel Inst. of Tech., Philadelphia, Pa. Wave Propagation Research Center.

WAVE PROPAGATION IN STEPPED AND JOINED SHELLS Annual Report, 1 Sep. 1968 – 1 Sep. 1969

Richard W. Mortimer, Pei Chi Chou, and Joseph L. Rose 24 Oct. 1969 37 p

(Grant NGR-30-004-013)

(NASA-CR-66921) Avail: NTIS CSCL 13M

In a continuous program of research, the following projects are reported: (1) The MCDIT-21 computer code was utilized to analyze shell impact problems involving cylindrical and conical shells. The computed results for cylindrical shell response include longitudinal stress, moment, and transverse shear stress. The computations for conical shells include the meridional stress, moment, and transverse shear stress distributions. (2) Experimental evaluations involved the use of a projectile velocity measurement system, utilization of the static handbook or manufactures listed properties for low speed impact tests, and an assessment of various strain gages which included adhesives and surface preparation. (3) A comparison was made of the experimental and analytical responses for cylindrical shells subjected to axial impact. The results are given along with a description of the data acquisition and test procedure. D.L.G.

N71-20726# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Flight Dynamics Lab.

STRUCTURAL RESPONSE OF A SHALLOW SPHERICAL SHELL Technical Report, Jul. - Dec. 1969

James L. Rudd Nov. 1970 76 p refs

(AD-716813; AFFDL-TR-70-110) Avail: NTIS CSCL 20/11

A comparison of the static solutions for a shallow spherical shell is presented for three thin shell computer programs. The comparison is made for a typical shallow spherical shell in order to compare the accuracy, the ease of input, and the required computer time for each program. The thin shell computer programs involved include a program using an exact solution, a numerical integration static program, and a finite difference static program developed by the North American Aviation Corporation. Author (GRA)

N71-20753# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

FRICTION UNDER CONDITIONS OF PLASTIC CONTACT

N. M. Mikhin 14 Oct. 1970 114 p refs Transl. into ENGLISH of the book "Trenie v Uslovikakh Plast. Kontakt." Moscow, Nauka Press, 1968 p 1 104

(AD-716970; FTD-HC-23-466-70) Avail: NTIS CSCL 13/9

The monograph is devoted to the study of the coefficient of friction on plastic contact, to the analysis of the initial displacement of solid bodies and to the determination of the dependence of the coefficient of friction on various parameters under the conditions of plastic contact. Phenomena taking place in the contact zone of solids during the initial period of sliding are discussed. Formulas are derived for calculation of the coefficient of friction of a spheric model of a rough surface in contact with an absolutely even surface, and the dependence of this coefficient on various factors is analyzed. The book is intended for scientists, engineers, and technicians concerned with the productions of friction materials and friction couples. Author (GRA)

N71-20754# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ESTIMATION OF STABILITY OF ELASTIC NONCIRCULAR CONICAL AND CYLINDRICAL ORTHOGONAL CASINGS

Yu. P. Petrov 16 Oct. 1971 36 p refs Transl. into ENGLISH from Samoletostr. Tekh. Vozdush. Flota (Kharkov), no. 15, 1968 p 75 89

(AD-717014; FTD-HC-23-460-70) Avail: NTIS CSCL 20/11

Noncircular conical and cylindrical shells, orthotropic and isotropic, are used in various branches of industrial construction: aircraft construction, ship construction, etc. The stability analysis of such shells, even in geometrically linear formulation, is a very complex problem. The solution of this problem with the aid of the presently known approximate analytic methods involves serious difficulties. It is probable that this is one of the reasons for the very small number of studies devoted to the stability of noncircular conical and cylindrical thin-wall shells. In the present paper this problem is solved by the differential-difference method, which is known in the literature as the method of straight lines or strip method. Author (GRA)

N71-20758# Naval Civil Engineering Lab., Port Hueneme, Calif.

FLAT DISC ACRYLIC PLASTIC WINDOWS FOR MAN-RATED HYPERBARIC CHAMBERS AT THE US NAVY EXPERIMENTAL DIVING UNIT

J. D. Stachiw Nov. 1970 41 p refs

(AD-716751; NCEL-TN-1127) Avail: NTIS CSCL 13/13

Flat disc acrylic plastic windows have been designed, fabricated, evaluated and delivered to EDU for replacement of glass windows used to date. Both large and small windows were found to be more than adequate for man-rated service under 450 psi maximum operational pressure in steel flanges with diameters of five and three inches. All windows were proofTested to 675 psi pressure at 120 F ambient temperature prior to delivery. Author

N71-20768# Rome Univ. (Italy). School of Aerospace Engineering.

A CONTRIBUTION TO THE THEORY OF MULTIWEB WING STRUCTURES [CONTRIBUTO ALLA TEORIA DELLE STRUTTURE ALARI MULTILONGHERONE]

Carlo Arduini and Giuliano Quazzo Jul. 1970 49 p refs In ITALIAN; ENGLISH summary *Its* ATTI del Centro Ric. Aerospaziali No. 29

Avail: NTIS

The problem of the torsion of a multiweb wing structure is analyzed in the presence of stresses normal to the plane of the section. The transmission along the span of the stiffening effect produced by the base section being built in is studied in detail. The analysis has been performed on a discrete scheme as well as on a continuous scheme when the webs are in very large number. Author (ESRO)

N71-20776# Air Force Systems Command, Wright-Patterson AFB, Ohio. Flight Dynamics Lab.

CRACKS: A FORTRAN 4 DIGITAL COMPUTER PROGRAM FOR CRACK PROPAGATION ANALYSIS Final Technical Report, Jul. 1969 - Mar. 1970

Robert M. Engle, Jr. Oct. 1970 61 p refs

(AD-717150; AFFDL-TR-70-107) Avail: NTIS CSCL 20/11

The report presents a detailed description of a computer program for analyzing crack propagation in cyclic loaded structures. The program has the option of using relationships derived by Forman or by Paris for crack growth. Provisions are made for both surface flaws and through cracks as well as the transition from the former to the latter. The program utilizes a block loading concept wherein the load is applied for a given number of cycles rather than applied from one cycle number to another cycle number. Additional features of the program are: variable print interval, variable integration interval, and optional formats for loads input. Detailed input instructions and an illustrative problem are presented. Author (GRA)

N71-20811# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STABILITY OF DEFORMABLE SYSTEMS

A. S. Volmir 22 Oct. 1970 113 p refs Transl. into ENGLISH from the book "Ustoichivost Deformiruemykh Sistem" Moscow, Nauka Press, 1967 113 p

(AD-716938; FTD-HC-23-465-70) Avail: NTIS CSCL 20/11

The book deals with the stability of various structural elements, such as bars, plates, shells, beams and frame works of different shapes and designs. It outlines certain problems of hydroelasticity, and aeroelasticity. Criteria of dynamic stability, of initial imperfection, excentric compression, dynamic programming and uses of analog computers are discussed. Author (GRA)

N71-20812# Watervliet Arsenal, N.Y.

THE INFLUENCE OF THE BAUSCHINGER EFFECT ON REVERSE YIELDING OF THICK WALLED CYLINDERS

R. Vincent Milligan Oct. 1970 24 p refs

(AD-717248; WVT-7036) Avail: NTIS CSCL 20/12

Critical diameter ratios for reverse yielding of thick-walled cylinders are calculated, taking experimentally determined values of the Bauschinger Effect into account. The tangential residual stresses at the inside surface of the tube are then calculated based on the critical diameter ratios. It is shown that the theoretical residual stresses are reduced by 54 and 38 percent, based on the 0.1 and 0.2 percent offset yield strengths used in determining the Bauschinger Effect parameters for the high-strength, low-alloy steel used as an example for this study. Author (GRA)

N71-20861# National Bureau of Standards, Washington, D.C. Building Research Div.

LUBBOCK TORNADO: A SURVEY OF BUILDING DAMAGE IN AN URBAN AREA

N. F. Somes, R. D. Dikkers, and T. H. Boone Mar. 1971 48 p refs

(NBS-TN-558) Avail: SOD $0.50

Damage to buildings and other structures caused by the tornado which struck Lubbock, Texas, on May 11, 1970, was ivestigated by photographic surveys on the ground and from a helicopter. It is concluded that current good practices in the design and construction of buildings and mobile homes would have greatly reduced the observed damage. It is also noted that natural disasters provide full scale tests of buildings. The development of performance criteria with respect to wind loads for certain building elements is advocated. Author

N71-20923# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

STRESSED STATE OF SLIGHTLY SLOPING ROTATIONAL SHELLS UNDER LARGE DISPLACEMENTS

Ya. F. Kayuk 26 Aug. 1970 14 p refs Transl. into ENGLISH from Mekh. Tverd. Tela. (Moscow), no. 5, 1969 p 159 163

(AD-717009; FTD-HT-23-367-70) Avail: NTIS CSCL 20/11

The problem of the stressed state of slightly sloping shells of rotation under high degrees of displacement is reduced to the integration of Karman equations under corresponding boundary conditions. These equations are solved by the small parameter method, where an analytical continuation method is used for expanding the region of applicability of the method. Author (GRA)

N71-20924# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

UTILITY AIRCRAFT

B. Lyanov 23 Oct. 1970 11 p Transl. into ENGLISH from Naukn.-Tekhn. Obshchestva SSSR (Moscow), v. 88, no. 4, 1966 p 30-33

(AD-717053; FTD-HT-23-122-70) Avail: NTIS CSCL 1/3

Discussed briefly are some of the problems which were encountered in the riveting and welding of D16T and V95T high-strength aluminum aircraft alloys, and which led to the development of the glue-welding technique used extensively in the construction of AN-24 aircraft (fuselage - 67 percent glue-welded). An 11-month comprehensive testing program is described and the successful use of FL-4S adhesive, cured 7 hrs at 140 degrees, is mentioned. The glue-welding technique is described in general terms and the subsequent use of KLN-1 and VK-1MS epoxy-thiokol resins (polymerized at 145-150 degrees centigrade) is reported. Author (GRA)

N71-21010# Army Missile Command, Redstone Arsenal, Ala. Structures and Mechanics Lab.

LARGE DEFLECTIONS ON n-LAYERED RECTANGULAR PLATES

Kenneth William Suits Dec. 1970 36 p ref

(AD-717245; RS-TR-70-9) Avail: NTIS CSCL 20/11

The report considers the large deflection of n-layered rectangular plates with clamped edges and a uniformly distributed load. The displacement and stress-strain relations for this plate with the above boundary conditions were obtained, using known Hookeian relations. From these, using the strain energy and variational methods, the required equilibrium equations were obtained. Author (GRA)

N71-21015# Brussels Univ. (Belgium). Lab. of Material Testing.

FATIGUE TESTS ON TRANSVERSE BUTTWELDED JOINTS CONTAINING BLOWHOLES [ESSAIS DE FATIGUE SUR SOUDURES BOUT A BOUT TRANSVERSALES CONTENANT DES SOUFFLURES]

Fernand Guyot and Jean Martelee (Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal.) Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal. Jun. 1970 77 p refs In FRENCH Sponsored by IRSIA

(CRIF-MT-53) Avail: NTIS

Details and results of fatigue tests by alternative drawing of standardized flat steel bars from 40 to 50 kg/sq mm with welded joints and porosity defects are discussed. Defects introduced in the welds are scattered, grouped or aligned and the first and the last types, either natural or artificial, are of different sizes. Comparison of the results with admissible stresses given in fatigue specifications shows that porosities are acceptable to a certain limit and for some duration of life. ESRO

N71-21030# Ghent Univ. (Belgium). Lab. of Materials Resistance.

STRESS MEASUREMENTS ON A DEGASSING VESSEL [MESURES DE CONTRAINTES SUR UN DEGAZEUR]

Joris Decock Brussels Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal. Aug. 1970 16 p refs In FRENCH Sponsored by IRSIA

(CRIF-MT-57) Avail: NTIS

Ohmic extensometers were used to evaluate actual stresses on a vertical cylindrical tank used for degassing materials and resting on a tripod. The influence of the support is discussed. It was found that the stresses at some spots were very much influenced by the supports, whereas at other points there were no changes.
ESRO

N71-21031# Liege Univ. (Belgium). Civil Engineering Construction Lab.
HIGH RESISTANCE PRESTRESSED BOLTED JOINTS [ASSEMBLAGES PAR BOULONS A HAUTE RESISTANCE TRAVAILLANT EN PIECES PRECONTRAINTES]
Jean Claude Lambert Brussels Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal. Oct. 1970 37 p refs In FRENCH Sponsored by IRSIA
(CRIF-MT-62) Avail: NTIS

Tests were devoted to pretightened bolts under static loads and to the determination of the compressed area as well as the influence of pretightness on the durability of such joints under dynamic loads. It is concluded that the ultimate resistance is independent of the value for joints submitted to static tests, but varies in the inverse ratio for joints submitted to dynamic tests.
ESRO

N71-21034# Societe Nationale Industrielle Aerospatiale, Paris (France).
STRUCTURAL TECHNOLOGY STUDIES APPLICABLE TO THE SPACE SHUTTLE
J. Dupin 1970 31 p Presented at the 4th EUROSPACE US-European Conf., Venice, 22 - 25 Sep. 1970
Avail: NTIS

The work undertaken in France, Germany, and particularly within SNIAS, in the field of structures for hypersonic vehicle gliders is reviewed. The studies most developed concern hot stressed structures with the skin used as a heat shield. To build such structures a new technology was developed around selected materials such as Rene 41, molybdenum, niobium, cobalt alloys, and pyrolitic graphite. Various techniques relevant to a space shuttle program are listed. Finally, tests carried out on a full scale model are given. It is concluded that a fruitful collaboration in the manufacture of projects such as space shuttle is possible.
ESRO

N71-21038# California Univ., Richmond. Forest Products Lab.
FORMULATION OF DISCRETE ELEMENT MODELS FOR STRESS AND VIBRATION ANALYSIS OF PLATES
C. D. Mote, Jr. Jan. 1971 70 p refs Sponsored by NSF
(Rept-35-01-77) Avail: Issuing Activity

The stress and vibration analyses of a saw require special computational techniques because of the unusual geometry and of the severe operating environment. Finite element numerical procedures for the calculation of natural frequencies and stresses that possess sufficient generality for nearly all saw problems were developed for such analyses. The theoretical basis for these computer codes is summarized, and theoretical questions associated with their development are discussed.
Author

N71-21045* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INFLATABLE SUPPORT STRUCTURE Patent
James E. Pleasants, inventor (to NASA) Issued 23 Jan. 1968 (Filed 13 Jan. 1965) 4 p Cl. 52-2
(NASA-Case-XLA-01731; US-Patent-3,364,631; US-Patent-Appl-SN-425365) Avail: US Patent Office CSCL 13M

A constant strength pneumatic cantilever beam is described along with a platform utilizing a number of the beams for support of inflatable structural panels. The circular cross section beam has a linear edge and an opposite edge conforming to the moment curve of the loads to be supported. The beam is preferably formed from a plastics material which may be sealed to a support and thus provide a completely inflatable, lightweight structure for use in low vacuum environments.
D.L.G.

N71-21046# Southampton Univ. (England). Inst. of Sound and Vibration Research.
VIBRATION ANALYSIS OF DOUBLY CURVED HONEYCOMB SANDWICH PLATES BY THE FINITE ELEMENT METHOD
K. M. Ahmed Sep. 1970 86 p refs Sponsored by Rohr Corporation, Calif.
(ISVR-TR-37) Avail: NTIS

The free vibration characteristics of doubly curved honeycomb sandwich panels are studied by the finite element method using five and seven degrees of freedom per node. Both constant and parabolic variation of strain in the core are used and comparison is made of their effect on free vibration. Various parametric studies were conducted to determine their effect on free vibration of flat and singly curved honeycomb sandwich panels. The seven degrees of freedom per node is found to yield more realistic answers than the five degrees per node element.
Author (ESRO)

N71-21062# Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 3, NO. 1
Jan. 1971 48 p refs
(AD-717046) Avail: NTIS CSCL 20/11

Contents: Effect of dynamic reaction on foundation input; News briefs Reviews of meetings; Short courses; Abstracts from the current literature (Analysis and design, Excitation, Phenomenology, Experimentation, Components, Systems); and Literature review. For Vol. 2 No. 12, see N71-19672.
GRA

N71-21133# Ecole Nationale Superieure de Mecanique, Nantes (France).
ANNALS OF MECHANICS - Semiannual Report, 1969 [ANNALES DE MECANIQUE Premier Semestre 1969]
1969 368 p refs In FRENCH
(SAR-1) Avail: NTIS

CONTENTS:

1. ON THE VECTORIAL BASES OF SOME TORSIONAL MODULES. NOTE ON THE IMMERSION OF A MODULE Xi AT THE nth POWER IN A REGULAR MODULE Marcel Vivia p 3 - 7 ref

2. INFLUENCE OF SWELL ON THE VERTICAL VIBRATION OF A FLOATING BEAM C. Cheze p 11 - 18 (See N71-21134 10-32)

3. COMPUTATION OF THE NATURAL FREQUENCIES OF A SHIP HULL C. Cheze p 19 - 48 (See N71-21135 10-32)

4. TRANSIENT MOTIONS OF A STRAIGHT SHAFT WITH NON-CIRCULAR CROSS-SECTIONS A. Ripianu (Polytech. Inst., Cluj) p 49 - 73 refs (See N71-21136 10-32)

5. A COMPUTATION METHOD FOR CALCULATING THE STRESSES AND DEFORMATIONS OF PLATES IN A U-TUBE HEAT-EXCHANGER UNDER THE ACTION OF PRESSURE AND TEMPERATURE Tran-Huu-Hanh p 76 - 103 refs (See N71-21137 10-32)

6. ON A MODIFICATION OF THE TOTAL RESISTANCE COEFFICIENT OF RAPID TRACTION E. Ravilly, P. Ollivia, and G. Reuille p 105 - 112

7. APPLICATION OF GUILLOTON'S METHOD TO THE CALCULATION OF KEEL RESISTANCE Nguen Van Goc p 113 - 126 refs

8. EXPERIMENTAL MEASUREMENT OF THE FRICTION MOMENT OF A CYLINDER ROTATING IN A FIXED CYLINDER FOR SMALL GAPS AND HIGH REYNOLDS NUMBERS P. Sulmont

and P. L. Bourget p 127 - 134 refs (See N71-21138 10-32)

9. STUDY OF A JET FROM A CONVERGENT NOZZLE P. Guevel, A. Belval, B. Grolleau, and J. Pouplard p 135 - 147 refs (See N71-21139 10-32)

10. TWO-DIMENSIONAL FLOW THROUGH AN EARTH WALL HAVING A FILTERING MAT P. Guevel and A. Vuez (INSA) p 149 - 164

11. CONTRIBUTION TO THE STUDY OF CRACKS PRODUCED BY VIBRATION OF A CONCRETE BEAM D. Le Houedec (p 165 - 178 refs

12. OPTIMAL COMMAND OF A BOILER H. Apter (Soc. CII), J. F. Le Corre (IVT), R. Mezencev, and Y. Thomas (CNRS) p 179 - 193 refs

13. SIMULATED IDENTIFICATION OF AN INDUSTRIAL PROCESS Ph. de Larminat and M. H. Tallec (INSA) p 194 204 ref

14. THEORY OF THE PHENOMENON OF SECONDARY ELECTRON EMISSION M. Cailler (IVT) p 205 - 215 refs (See N71-21140 10-32)

15. EQUATIONS FROM THE DIFFUSION PHENOMENON AND THE KIRKENDALL EFFECT J. Pouliquen p 217 - 229 refs (See N71-21141 10-32)

16. TIME CONSTANT EFFECT IN THE RECORDING OF A DIFFRACTION LINE R. Cheron p 231 - 233 refs (See N71-21142 10-32)

17. DESIGN STUDY OF A DIGITAL COUNTER J. Paillier, R. Pointeau and R. Mezencev p 235 refs (See N71-21143 10-32)

18. TECHNOLOGY OF A PILOT PLANT FOR ISOMERIZATION OF XYLENES C. Laurgeau and R. Pointeau p 258 - 273 refs

19. USE OF THE LATIN SQUARE TO STUDY THE INFLUENCE OF THE INITIAL STATE ON TEMPERING ABILITY OF NON-ALLOYED STEELS R. Moreau, A. Ducoin, and C. Bouchy p 275 - 303 (See N71-21144 10-32)

20. DESIGN OF AN ELECTROLYTIC SEPARATION METHOD FOR CARBIDES IN HIGH TEMPERATURE RESISTANT STAINLESS STEELS 25% Cr - 20% Ni M. Geier and F. Gobin p 305 - 342 refs (See N71-21145 10-32)

21. DRILLING OF LIGHT ALLOYS (AS7G-AS19G) J. C. Friloux and F. Le Maitre p 343 - 352 (See N71-21146 10-32)

22. CONTRIBUTION TO THE STUDY OF THE DURATION OF QUICK STEEL TOOLS Y. Couchourel, M. Sautereau, and F. Le Maitre p 353 - 369

N71-21134# Ecole Nationale Superieure de Mecanique, Nantes (France).

INFLUENCE OF SWELL ON THE VERTICAL VIBRATION OF A FLOATING BEAM [INFLUENCE DE LA HOULE SUR LES VIBRATIONS VERTICALES D'UNE POUTRE FLOTTANTE]

Claude Cheze *In its* Ann. of Mech. Semiann. Rept., 1969 p 11 - 18 In FRENCH (See N71-21133 10-32)
Avail: NTIS

The vibration of a floating elastic beam with constant rectangular cross-section is analyzed. It is shown that the deformation of the liquid due to the vibration of the beam floating on it induce a noticeable change in the vibration frequency of the beam. The value of this change has been evaluated for the case of cylindrical sinus deformations. ESRO

N71-21135# Ecole Nationale Superieure de Mecanique, Nantes (France).

COMPUTATION OF THE NATURAL FREQUENCIES OF A SHIP HULL [CALCUL DES FREQUENCES NATURELLES D'UN BATEAU]

Claude Cheze *In its* Ann. of Mech. Semiann. Rept., 1969 p 19 - 48 In FRENCH (See N71-21133 10-32)
Avail: NTIS

A review is presented of the different methods used to compute resonant frequencies of ship hulls. Methods discussed are the Stodola graphic method, the analog rheolectrical method, the digital Prohl and Myklestad method, and the energy method. ESRO

N71-21137# Ecole Nationale Superieure de Mecanique, Nantes (France).

A COMPUTATION METHOD FOR CALCULATING THE STRESSES AND DEFORMATIONS OF PLATES IN A U-TUBE HEAT EXCHANGER UNDER THE ACTION OF PRESSURE AND TEMPERATURE [METHODE DE CALCUL DES CONTRAINTES ET DES DEFORMATIONS DES PLAQUES D'ECHANGEUR DE CHALEUR A TUBES EN U SOUS L'ACTION DE LA PRESSION ET DE LA TEMPERATURE]

Tran-Huu-Hahn *In its* Ann. of Mech. Semiann. Rept., 1969 p 76 - 103 refs In FRENCH (See N71-21133 10-32)
Avail: NTIS

A method is described which analyzes force distribution in perforated plates and computes the discontinuity forces. Useful data for the computation of stresses and deformations of a perforated plate as well as the limit of the different stresses are presented according to the current ASME code. ESRO

N71-21173# University of Southern Calif. Los Angeles.

FREE VIBRATIONS OF PARABOLOIDAL SHELLS OF REVOLUTION

D. S. Margolias and V. I. Weingarten [1971] 33 p refs Sponsored by NSF
Avail: Issuing Activity

A large digital computer problem employing the finite element method is used to perform a parametric free vibrations analysis of paraboloidal shells of revolution. A curved meridian, frustum shell element is used, and Sanders' shell equations are combined with an assumed displacement field to evaluate the total energy of the discretized shell. Variations in the paraboloid radius, thickness and focal length, and in an externally applied hydrostatic pressure are all examined to determine their respective effects on the natural frequencies. The existence of an optimum focal length to maximize the stiffness of the overall shell is also shown. Author

N71-21174# University of Southern Calif., Los Angeles. Dept. of Civil Engineering.

THE EFFECT OF LATERAL PRESSURE ON THE NATURAL FREQUENCIES OF HYPERBOLOIDAL SHELLS OF REVOLUTION

Mehran Lashkari, Victor I. Weingarten, and David S. Margolias [1971] 30 p refs Sponsored by NSF
Avail: Issuing Activity

The effect of external and internal lateral pressure on the free vibrations of hyperboloidal shells of revolution is investigated. A finite element computer program was developed based on Sander's linear shell theory. The analysis was in good agreement with available experimental results. It was determined that a zero frequency load condition, which defines the buckling pressure, can exist for both internal and external lateral pressure loadings. Author

N71-21175# University of Southern Calif., Los Angeles.

THE INEXTENSIONAL VIBRATIONS OF PARABOLOIDAL SHELLS OF REVOLUTION

David S. Margolias and Victor I. Weingarten [1971] 15 p refs Sponsored by NSF
Avail: Issuing Activity

The inextensional vibrations of paraboloidal shells of revolution are compared to the results obtained using Sanders' shell theory wherein both membrane and bending terms are included. The finite element method is used to solve Sanders' shell equations by

employing a curved meridian frustum element. Vibration results of the two theoretical studies are first compared with experimental results and then with each other for both deep and shallow paraboloids. Author

N71-21190# Lehigh Univ., Bethlehem, Pa.
AXISYMMETRIC POSTBUCKLING AND NONSYMMETRIC BUCKLING OF A SPHERICAL SHELL COMPRESSED BETWEEN RIGID PLATES
Dean P. Updike and Arturs Kalnins 1 Jul. 1970 39 p refs
(Contract N00014-67-A-0370-0003)
(AD-716791; TR-2) Avail: NTIS CSCL 20/11

The present paper presents an analysis of the stresses and deflections produced during axisymmetric post-buckling and determines the deformation states at which the shell may buckle into a nonsymmetric shape. The analysis accounts for finite deflections and rotations, but assumes that the material remains linearly elastic throughout the deformation. Author (GRA)

N71-21192# Ballistic Research Labs., Aberdeen Proving Ground, Md.
LARGE DEFLECTION ELASTOPLASTIC RESPONSE OF SHELL STRUCTURES
Norris J. Huffington, Jr. Nov. 1970 21 p refs
(AD-717005; BRL-1515) Avail: NTIS CSCL 20/11

A finite difference procedure has been formulated for predicting the response of thin structural shells to severe transient loading which may induce large deflections and anelastic material behavior. A computer program, REPSIL, has been developed to facilitate use of this analytical procedure. To exemplify the application of this technique, the response of a cylindrical shell to a surface blast loading was predicted and found to be in satisfactory agreement with experimental data. Author (GRA)

N71-21193 National Lending Library for Science and Technology, Boston Spa (England).
THEORETICAL AND EXPERIMENTAL STRESS ANALYSIS OF HEATED STRUCTURES
H. Eschenauer et al 18 Aug. 1970 24 p refs Transl. into ENGLISH from Proceedings of i Mech.E/J. Brit. Con. for Stress Analysis Conf. (Cambridge), 6-10 Apr. 1970 *Its* Paper No. 41
(NLL-CE-Trans-5403-(9022.09) Avail: Natl. Lending Library, Boston Spa Engl.

The stresses in isotropic structures (plates, shells) under quasi-stationary temperature loads are theoretically and experimentally investigated. The thermoelastic equations and methods of solution are presented. For experimental stress analysis, given non-uniform and time-dependent temperature fields were simulated by a radiant heating system. Measurements of strains and deformations are described. Theoretical and experimental results for three structures (cantilever plate, annular circular plate, cylindrical shell with intermediate diaphragm plate) are discussed. Stress fields in the structures, maximum stresses as a function of time for a given temperature-time program, influence of various geometric parameters, and thermal buckling are considered. Author

N71-21215*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A SPECIALIZED MODEL FOR ANALYSIS OF CREEP RUPTURE DATA BY THE MINIMUM COMMITMENT, STATION-FUNCTION APPROACH
S. S. Manson and C. R. Ensign [1971] 14 p ref Presented at AGARD Meeting on Struct. and Mater., London, 29 Mar.–2 Apr. 1971
(NASA-TM-X-52999) Avail: NTIS CSCL 20K

In the approach considered, the hypothesized time-temperature-stress relation is taken in sufficiently general form to include all commonly used parameters, so that each has a equal chance to emerge as the proper one. The functional forms involved in the relation are not taken in analytical form; rather they are defined as station functions with their numerical values at selected station values of the independent variable. The use of station functions not only avoids forcing the pattern of the data, but provides an incidental benefit in avoiding ill-conditioning of the system of resulting equations, which are computer-solved for the optimum data representation. This feature also contributes to the objectiveness of the method, and gives each time-temperature parameter consistent with the model an equal chance to demonstrate itself as the correct one. Author

N71-21260 Northwestern Univ., Evanston, Ill.
DYNAMIC RESPONSE TO MECHANICAL SYSTEMS WITH CHANGING BOUNDARIES
Manuel Americo J. Goncalves da Silva (Ph.D. Thesis) 1969 107 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 70-6533

An analytical treatment of problems of dynamic response of linearly elastic structural models (string, membrane, beam and plate) with changing boundaries is presented, based on an amplitude perturbation scheme. The deflections experienced by the systems investigated are assumed to be small, so that the nonlinear character of the problems is due exclusively to the moving boundary. The changing boundary is introduced either by a rigid punch vibrating on the suface of the system or by a displacement constraining wall on the vicinity of the end points. The contact between the surfaces is assumed to be frictionless. Two alternate approaches of dealing with the nonlinearity are considered, one entailing a change of variables leading to a fixed domain and the other utilizing a Taylor series expansion about the static configuration. Particular attention is devoted to the motions of steady character. A brief reference is made to problems of transient excitation. The analytical expressions are specialized for the case of a parabolic indenter or a parabolic guiding wall. Dissert. Abstr.

N71-21261 Clemson Univ., S.C.
ON THE DYNAMIC STABILITY OF SIMPLY-SUPPORTED RECTANGULAR SANDWICH PLATES AND CIRCULAR CYLINDRICAL SANDWICH PANELS
Conor Deane Johnson (Ph.D. Thesis) 1969 167 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 70-6277

A theoretical study of the dynamic stability of simply-supported sandwich plates and circular cylindrical sandwich panels under uniformly distributed, periodic edge loads is presented. The time-dependent edge loads consist of steady components and periodic components which are harmonic, impulsive, or vary according to an arbitrary piecewise constant law. The equations of motion are derived by the calculus of variations and Trefftz's principle for static analysis of mechanical systems extended by Hamilton's principle to dynamic analysis. The mathematical model of the sandwich element employed in this investigation accounts for dissimilar, isotropic face-sheets, which are assumed capable of resisting bending and stretching deformations. The core material is assumed to be a homogeneous orthotropic continuum, capable of resisting only transverse shearing deformations. The deformed configuration of the general cylindrical sandwich shell is specified in terms of the displacement components of points lying on the middle surfaces of the two face-sheets. Quadratic terms involving derivatives of the transverse displacement are retained. Dissert. Abstr.

N71-21267 Columbia Univ., New York.
WAVE PROPAGATION IN AN ELASTO-PLASTIC MATERIAL CONTAINED IN A CYLINDRICAL SHELL

John Thomas Kovarna (Ph.D. Thesis) 1969 96 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 70-7010

The problem of the longitudinal propagation of axially symmetric waves in a semi-infinite cylindrical body restrained in the radial direction by a thin elastic shell is considered. The shell is assumed to consist of an assemblage of stacked rings which do not interact with one another in the axial direction. This arrangement eliminates axial wave propagation in the restraining shell, a highly desirable simplification. The material of the cylindrical body is taken to be a homogeneous and isotropic elasto-plastic material (of the Coulomb type) governed by a yield condition and plastic potential. The elastic behavior is assumed linear in the deviators, but nonlinear (hardening) in bulk. Such a material has the property that at any instant of time there exist, in general, two types of regions (elastic and plastic) governed by different sets of equations, and the extent of these moving regions is to be determined in the solution process. The approach presented is also suitable for any other material prescription. Dissert. Abstr.

N71-21268 Univ. of Southern Calif., Los Angeles.
THE PROBLEM OF SAFETY OF STEEL STRUCTURES SUBJECTED TO SEISMIC LOADING
Sun- ju Hung (Ph.D. Thesis) 1969 147 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 70-5217

Due to the fact that the characteristics of ground motions and the material properties of buildings are random in nature, the probabilistic theory is employed in the response and safety analysis of buildings subjected to seismic loading. The shear building concept is used in the response analysis of a one-story building and then the results are extended analogously to the investigations of multistory buildings. A bilinear stress-strain relation is assumed for the material. Structural damping, caused by the plastic deformations, is accounted for by complex stiffnesses. The probable number of stress cycles within the service time of the structure is then estimated using the results of responsive analysis and the statistics of the earthquake occurrence and intensity. Safety analysis of the steel structure is performed on the basis of a statistical cumulative fatigue damage theory. As a numerical example, the safety of a four-story steel structure is investigated with the aid of electronic digital computers. Dissert. Abstr.

N71-21273 Virginia Polytechnic Inst., Blacksburg.
STRESS DISTRIBUTION IN A WEDGE CONTAINING A PAIR OF SEMICIRCULAR NOTCHES
Ching Yu Hou (Ph.D. Thesis) 1969 126 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 70-5355

A solution for the stresses in an infinite wedge containing a pair of symmetrically located semicircular notches of equal radii is presented. The wedge is under given tractions along the straight portions of the edges while the rims of notches are free from tractions. Such edge tractions can be decomposed into two systems: one is even, and the other is odd, with respect to the axis of the wedge. By superposition, a notched wedge under any given tractions can be solved. The wedge is supposed in a state of generalized plane stress. The stress function in question is assumed to compose two parts: (1) a basic stress function which is the stress function for an unnotched wedge under even or odd tractions along the edges, and (2) an auxiliary stress function which is added to allow for the effect of notches. The auxiliary stress function is constructed by combining linearly two sets of biharmonic functions derived by successive differentiation from appropriate Shepherd's solutions, two for the even case and the remaining two for the odd case. Dissert. Abstr.

N71-21274# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPARATUS AND TECHNIQUE FOR STUDYING FRICTION AND WEAR OF MATERIALS IN A LIQUID NITROGEN MEDIUM
A. A. Zaporozhets 9 Oct. 1970 11 p refs Transl. into ENGLISH from Russian Conf. Proc.
(AD-716972; FTD-HT-23-441-70) Avail: NTIS CSCL 14/2

The design and operation of an apparatus, MTCH-1, for studying friction and wearing processes at low temperature is described. The ends of 2 hollow cylindrical samples outside diam. 16 x inside diam. 8 x 12 mm and outside diam. 15 x inside diam. 9 x 12 mm., resp., immersed in liq. N were rotating one against the other at a const. velocity of 0.039 m/sec under specific loadings of 0.2-1.0MN/m(superscript 2). The wearing of materials were estd. by linear measurements or by weighing. An equation to estimate the friction factor and results for some pure metals (Fe, Mo, Ti, Al) and special steel 38KhmYua are presented. Author (GRA)

N71-21350*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLIED MECHANICS
In its Space Programs Sum. No. 37-66, Vol. 3, Oct.–Nov. 1970 31 Dec. 1970 p 120–144 refs (See N71-21338 10-30)
Copyright. Avail: NTIS CSCL 13M

A method is developed for predicting quantitatively the reliability of pressure vessels under both static loadings and random dynamic disturbances; the relationship between the safety factor and structural reliability determines creep failures of the randomly excited structures and the effects of loading histories. Limiting forms for general equations governing the nonlinear, thermoelastic behavior of thin shells of revolution are derived for the case where the shell is thin enough for a boundary layer to develop and where the shallow shell is uniformly heated. An order of magnitude analysis is presented for shell equations derived by Reissner's variational theorem that can be applied to specific shallow shell heating problems where no temperature gradient is considered. G.G.

N71-21366 University of Southern Calif., Los Angeles.
THE NATURAL MODES AND FREQUENCIES OF A UNIFORM CURVED BEAM VIBRATING IN THE PLANE OF THE BEAM
Sam Silverberg (Ph.D. Thesis) 1969 104 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 70-5226

The equations of motion for a uniform curved beam with general boundary conditions and a technique for solving these equations are presented. The expressions for the internal shear forces, axial forces, and bending moments are developed using the results of an investigation into the kinematics of curved beams. The expressions include the interaction of the axial force and bending moment resulting from the separation of the neutral axis and the centroidal axis. The differential equations of motion are derived, which take into account the distance of the center of mass of a differential element from the centroidal axis. The solution, which is approached through a separation of variables technique, leads to a 6th order equation for the spatial frequency. The implications of the possible forms of the solution are discussed. General boundary conditions are introduced, which lead to 6 simultaneous homogeneous equations. The technique for solving these equations and determining the natural modes and frequencies is described. Dissert. Abstr.

N71-21367# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATING FLEXURE AND STABILITY OF RECTANGULAR AND NONRECTANGULAR ANISOTROPIC PLATES BY THE DIFFERENTIAL DIFFERENCE METHOD
Yu P. Petrov 27 Oct. 1970 23 p refs Transl. into ENGLISH from Samoletostroenie i Tekhn. Vozdushnogo Flota (USSR), no. 15, 1968 p 61–74

(AD-716979; FTD-HC-23-461-70) Avail: NTIS CSCL 20/11

The differential equation of flexure and stability of an elastic anisotropic plate contains odd partial derivatives along with the even partial derivatives with respect to both variables. This does not permit direct application of the generally known and well-tested method of double and single trigonometric series for calculation of flexure and stability of such plates. Use of variation methods is connected with the necessity of approximating the solution of the problem by well-selected functions known in advance and partially or completely satisfying the boundary conditions. With the exception of individual special cases, this is very difficult to do for anisotropic plates. Thus, at the present time, it is obvously necessary to consider numerical methods more efficient for calculating flexure and stability of anisotropic plates. One of them is the differential-difference method or the method of straight lines. In a given reference, this method was extended to the problem of flexure and stability of orthotropic rectangular plates. An effort is made to demonstrate the possibility of successful application of the differential-difference method for solving the stated problem.
Author (GRA)

N71-21381# North Carolina State Univ., Raleigh. Applied Mathematics Research Group.

THE EFFECT OF PARTIAL CLOSURE ON THE STRESS INTENSITY FACTOR OF A GRIFFITH CRACK OPENED BY A PARABOLIC PRESSURE DISTRIBUTION

E. E. Burniston and W. Q. Gurley 1 Nov. 1970 30 p refs
(Grant AF-AFOSR-1779-69)
(AD-717184; AFOSR-70-2907TR) Avail: NTIS CSCL 20/11

The problem of a Griffith crack in a thin plate, which is opened by a parabolic pressure acting on its surfaces is considered. The crack is then partially closed in a symmetric manner by ties, idealized by point loads in the material, and the effect upon the stress intensity factors is discussed.
Author (GRA)

N71-21389 Northwestern Univ., Evanston, Ill.

TRANSIENT STRESS RESPONSE OF A LAMINATED COMPOSITE TO A TRANSVERSE LOADING

Leonard Eugene Voelker (Ph.D. Thesis) 1969 109 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 70-6544

The transient response of an unbounded laminated medium, composed of alternating layers of two homogeneous isotropic elastic materials, is investigated. The medium is subjected to uniformly distributed transverse forces, which are suddenly applied in a plane perpendicular to the layering. The two-dimensional wave propagation problem is first investigated by employing the theory of linear elasticity for each one of the layers. The antisymmetry of the applied load reduces the system of governing equations to four equations with four boundary, or interface, conditions. The problem is analyzed by using the technique of modal analysis, in conjunction with a Fourier integral representation of the applied load. The analysis is restricted to the evaluation of the normal stresses and the shear stresses at the interfaces between any two adjacent layers.
Dissert. Abstr.

N71-21396 Minnesota Univ., Minneapolis.

STABILITY OF ELASTIC PLATES VIA LIAPUNOV'S DIRECT METHOD

Gary John Stroebel (Ph.D. Thesis) 1969 132 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 70-5610

The buckling and post-buckling behavior of a thin, elastic plate subjected to compressive forces along its edge is discussed. It is well-known that the flat plate will buckle at a critical value of a loading parameter. However, the plate, unlike the one-dimensional beam, can sustain loads far in excess of this initial buckling load. Mathematical studies have proven that a branch of nontrivial solutions bifurcates from each eigenvalue of the linearized plate equations. Moreover, these solutions are continuable for indefinitely large values of the load. Previous studies indicate that a given buckled solution may be stable only for a certain range of loads. Experimental results with rectangular plates show that there exist edge loads at which the plate will suddenly jump from one buckled state to another.
Dissert. Abstr.

N71-21397 California Univ., Berkeley.

THE DEFORMATION AND FRACTURE OF RIGID CELLULAR PLASTIC UNDER MULTIAXIAL STRESS

Mahadeo Ratilal Patel (Ph.D. Thesis) 1969 206 p
Avail: Univ. Microfilms: HC $9.45/Microfilm $3.00 Order No. 70-6189

Without using any simplifying assumptions regarding the shape of a unit cell, but using the relative sizes and mutual arrangement of the struts and the cell-walls, a model is developed for the behavior of foams under uniaxial and multiaxial loads. This model has been extended to explain the post-yield behavior of foams under compression. Also a fracture-yield criterion has been developed to set up the limits of elastic behavior for foams under general states of loading. The model explains such varied effects as: (1) increase in fracture strength in tension with reticulation, (2) decrease in yield strength in compression with reticulation, (3) the higher yield strength and the lower strain-hardening rates of anisotropic foams in the direction of foam rise, (4) the disappearance of the sharp yield point in compression of anisotropic foams as the loading direction is rotated away from the direction of foam rise, and (5) the differences in Poisson's Ratios in compression and tension.
Dissert. Abstr.

N71-21398 California Univ., Berkeley.

OSCILLATIONS ON NONLINEAR DAMPED SYSTEMS WITH MANY DEGREES OF FREEDOM

Cheng-ching Chi (Ph.D. Thesis) 1969 89 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 70-6075

A system of n masses, equal or not, interconnected by springs and dampers, linear or nonlinear, and having n degrees of freedom is examined. The spring forces are assumed to be symmetric to the origin, while the damping forces are assumed to oppose the motion. Liapunov's direct method is used to examine the stability of the general motion of the system whose dissipation function may be complete or incomplete. The concept of normal-mode vibrations of damped, nonlinear systems is rigorously defined. Geometrical method is used to deduce qualitative properties of normal-mode vibrations. Under the assumption that the associated undamped system posesses at least one normal mode, conditions for the existence of normal modes of damped, nonlinear systems are established.
Dissert. Abstr.

N71-21399 California Univ., Berkeley.

SOME PROBLEMS IN THE THEORY OF VISCOELASTIC PLASTIC MEDIA

Tien-yuh Chuang (Ph.D. Thesis) 1969 78 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 70-6077

Solutions of a viscoelastic-plastic hollow circular cylinder in the state of plane strain are obtained on the basis of a three-dimensional theory of viscoelastic-plastic solids with the use of Mises and Tresca type loading functions. Both incompressible and compressible solutions are discussed. The constitutive equations and thermodynamical restrictions for a viscoelastic-plastic Cosserat surface are discussed in general and then attention is confined to linear theories with special reference to extensional and flexural deformation of linear isotropic viscoelastic-plastic (Cosserat) plate. The constitutive coefficients of the lattar results are identified in terms of the corresponding constitutive coefficients of the three-dimensional theory.
Dissert. Abstr.

N71-21659*# National Aeronautics and Space Administration, Washington, D.C.
NASTRAN: A SUMMARY OF THE FUNCTIONS AND CAPABILITIES OF THE NASA STRUCTURAL ANALYSIS COMPUTER SYSTEM
Thomas G. Butler and Douglas Michel 1971 27 p
(NASA-SP-260) Avail: NTIS; SOD $0.35 CSCL 20M

NASTRAN is described as a general-purpose digital computer program designed to analyze the behavior of elastic structures under a range of loading conditions using a finite-element displacement method approach. The current capability of the program is described. It includes a broad capability in solving linear static, dynamic, and eigenvalue problems, and a limited capability for solving some nonlinear problems. A detailed description is given of the current library of elastic elements in NASTRAN. Included are bars, rods, tubes, membranes, shear and twist panels, triangular and quadrilateral plates, conical and toroidal shells, solids of revolution, scalar elements, general elements, and constraint elements. The NASTRAN geometrical systems and material properties are also discussed.
Author

N71-21677# Lockheed Missiles and Space Co., Palo Alto, Calif.
CARRYING CAPACITY OF A TOROIDAL SHELL
A. N. Semenenko [1970] 5 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mashinostro. (Moscow), no. 12, 1970 p 18–21
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A computation is presented for finding the upper bound values of the loadings acting on a toroidal shell fabricated from a rigidly ideally plastic material and loaded by self-equilibrated stress resultants.
Author

N71-21647 Ohio State Univ., Columbus.
AN ANALYTICAL INVESTIGATION OF THE LARGE DEFLECTIONS OF FLEXIBLE BEAM SPRINGS
Terry Emerson Shoup (Ph.D. Thesis) 1969 145 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 70-6882

The objectives were to investigate the feasibility of using the large deflections of flexible beams to produce nonlinear spring rates and to develop techniques and curves for the systematic design of compression and torsion springs. The scope is limited to seven basic flexible beam springs having clamped, pinned, or free ends. The beams are initially straight, have constant cross section and elastic properties, and are loaded at the ends only. The effects of axial strain when compared with bending deflections and dynamic effects are neglected. FORTRAN 4 computer programs were developed to solve the equations of the undulating elastica which describe these devices. Using the nondimensional curves, example spring designs are presented. These examples include the design of a nonlinear compression spring, a nonlinear torsion spring, and a toggle mechanism. These designs are accomplished for specific load and deflection requirements and design stress limitations.
Dissert. Abstr.

N71-21672*# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
DETAILED EXTENSIONS OF PERTURBATION METHODS FOR NONLINEAR PANEL FLUTTER Technical Report, 11 Dec. 1969–15 Mar. 1971
Luigi Morino and Ching-Chiang Kuo Mar. 1971 145 p refs
(Grant NGR-22-009-387)
(NASA-CR-117504; ASRL-TR-164-2) Avail: NTIS CSCL 13M

Nonlinear panel flutter problems are analyzed by using the multiple time-scaling technique. The von Karman equations and the Galerkin method are used to derive a system of nonlinear ordinary differential equations. Three analyses are presented. First, the flutter solution is given up to the fifth order; this shows that the limit cycle predicted by the third-order analysis may disappear if a certain condition is satisfied. Second, the interaction of buckling and flutter is analyzed; the steady-state solution is given in terms of Jacobian elliptic functions. Third, the effect of small damping terms is analyzed. Limitations of the method are indicated and suggestions for future analysis are given. A comparison with a generalization of the two-time-scaling technique by Cole and Kevorkian is also made. The results obtained with the two methods are in full agreement.
Author

N71-21690 National Lending Library for Science and Technology, Boston Spa (England).
VIBRATION OF ELASTIC CYLINDRICAL RODS IN LIQUIDS [KOLEBANIYA UPRUGIKH TSILINDRICHESKIKH STERZHNEY V ZHIDKOSTI]
P. P. Kulmach Aug. 1970 13 p refs Transl. into ENGLISH from Izv. Vses. Nauchn.-Issled. Gidrotekh. (USSR), v. 79, 1965 p 90–99
(NLL-RTS-5849) Avail: Natl. Lending Library, Boston Spa, Engl.: 26 s; 4 NLL photocopy coupons

A solution is given of the problem of transverse vibrations of elastic vertical rods of circular section in liquids. The rods are considered as systems with an infinite number of degrees of freedom. The results can be used to determine hydrodynamic pressures and the inertia effect. The results of the work can be applied in various branches of engineering. They apply directly to calculations of vibrations of piles, columns and other structural components in contact with a liquid medium. A general solution of the problem of transverse vibrations of vertical cylindrical rods in an unbounded body of liquid at rest is given. The liquid is assumed ideal and the problem three-dimensional. The method by which the rods are fixed at the bottom and at the free surface can vary.
Author

N71-21692 California Univ., Berkeley.
STABILITY OF SADDLE LIKE DEFORMED CONFIGURATIONS OF PLATES AND SHALLOW SHELLS
Shien Shien Lee (Ph.D. Thesis) 1969 147 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 70-6152

Nonlinear problems of infinite plates and shallow shells under doubly periodic surface loads are presented. Next, plates and shallow shells of circular base subjected to periodic transverse forces along the circular rim are investigated and finally square plates, flat or curved, subjected to transverse concentrated forces at the four corners are considered. The drastically different behaviors predicted by the linear and nonlinear theories are analysed and discussed. It is found that for problems of this type the transition from the small to the large deflection behavior involves nonlinear bifurcation and the existence of multiple equilibrium configurations which, in turn, entails the question of stability. When the problems are viewed and analysed in this manner, it is easy to explain various features special to problems in this class including certain jump phenomena.
Dissert. Abstr.

N71-21696# Ohio State Univ. Research Foundation, Columbus.
PLASTIC STRAIN CONTROLLED FAILURE CRITERIA AND DESIGN PARAMETERS Technical Progress Report
W. P. Meyerer, S. Kobayashi, J. Vanecko, A. Chakrabarti, D. Firrao et al 2 Jul. 1970 88 p refs
(Contract AT(11-1)-2048)
(COO-2048-1) Avail: NTIS

The role of plastic instability in pure shear in limiting allowable plastic strain, particularly at a discontinuity (notch effect) is being studied. Previous research has revealed that this instability is basic in the strength transition in notch toughness in heat treatable high strength steel. The subjects reported on include the theory of plastic instability, effects of elevated temperatures and strain rate,

effects of degree of saturation of terminal solid solutions, the role of instability in the temperature transition in toughness, and evaluation of the Gerard–Papirno characterization of notch ductility by their ductility ratio. Author (NSA)

N71-21733# Forest Products Lab., Madison, Wis.
FATIGUE PROPERTIES OF TITANIUM AND NICKEL BASE SANDWICH CONSTRUCTIONS
Paul M. Jenkinson Dec. 1970 35 p
(AD-716731; FSRP-FPL-147) Avail: NTIS CSCL 13/13

Fatigue properties were evaluated for sandwich constructions of titanium and nickel-base alloys having facings resistance-welded to honeycomb cores. Cores were of corrugated foil formed to 1/4-inch-squared honeycomb cells. Flatwise tension and flatwise shear properties were evaluated at 75F, for three constructions of each type. Edgewise compression fatigue properties were evaluated for two constructions of each type. Endurance limits of the sandwich tested were about 10 to 13 percent of static strength in flatwise tension, 10 to 20 percent in flatwise shear, and 40 to 70 percent in edgewise compression. Author (GRA)

N71-21767 Colorado Univ., Boulder.
AXISYMMETRIC DEFORMATION OF THIN SHALLOW ELASTIC SPHERICAL SHELLS WITH SURFACE CONSTRAINTS
Richard Hubert Fashbaugh (Ph.D. Thesis) 1969 80 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 70-5842

The axisymmetric deformation was investigated of thin shallow elastic spherical shells of uniform thickness with a portion of the surface partially constrained from normal displacement by a smooth rigid spherical surface. A solution is obtained that is within the scope of the shallow shell theory that relaxes the Kirchhoff-Love hypothesis by including the effect of transverse shear deformation. This solution is compared to the solution from Marguerre's classical linear theory, which utilizes the Kirchhoff-Love hypothesis. A specific numerical example is presented in which the shell edge meridional and normal displacement components and the rotation of the normal to the middle surface are prescribed. This example illustrates the effect of the shell edge boundary displacement on the character of the region of contact between the shell and the constraining surface. Dissert. Abstr.

N71-21776# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.
FRACTURE AND STRESS WAVES IN GLASS AND POLYMER PLATES UNDER TRANSVERSE DYNAMIC LOADINGS Final Report, Apr. 1969–Dec. 1970
Y. M. Tsai 1970 10 p refs
(Grant NSF GK-4671)
(PB-196353; ISU-ERI-AMES-91700) Avail: NTIS CSCL 20K

The impact of spheres on elastic plates of finite thickness overlying a rigid foundation is studied. A general calculation method is described to account for the effect of plate thickness on stresses in plate and contact time between the plate and sphere. Experiments are conducted to measure contact times and fracture velocities for steel balls impinging on glass plates of various thicknesses overlying a large steel block. It is shown both theoretically and experimentally that for sufficiently large steel balls the contact time decreases with decreasing plate thickness, and good agreement between theory and experiment is obtained. Author (GRA)

N71-21803# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
BRIEF HANDBOOK FOR THE SUM OF TWO HARMONICS
John Dugundji and Prakash Hora Nov. 1970 48 p
(Contract F44620-69-C-0091)
(AD-717201; ASRL-TR-159-2; AFOSR-70-2515TR) Avail: NTIS CSCL 20/11

A systematic illustration of the sum of two harmonics is presented. Various patterns for the response such as waviness, beats, and jiggles are obtained. The general relation of these patterns to the frequencies and amplitudes of the two harmonics is indicated. The patterns are shown to be repeatable for phase shifts of generally less than 360 degrees between the two harmonics. Numerous and systematic examples for the responses are given over a wide range of frequencies, amplitudes, and phase angles. Author (GRA)

N71-21804# New York Univ., N.Y. Dept. of Aeronautics and Astronautics.
BUCKLING OF A CIRCULAR ELASTIC RING CONFINED TO A UNIFORMLY CONTRACTING CIRCULAR BOUNDARY
Lotfi El-Bayouny Sep. 1970 49 p refs
(Grant AF-AFOSR-0813-67)
(AD-716862; NYU-AA-70-18; AFOSR-70-2337TR) Avail: NTIS CSCL 20/11

The present paper contains a detailed analysis of the title problem. Also included is a review of related buckling problems available in the literature. The buckled configuration is assumed to consist of two regions, viz., the detached region, where shallow arch approximations are adopted, and an attached region, where the ring assumes a constant curvature. The problem is treated as a variational problem with variable end points for which the variational formulation yields, in addition to the differential equations and boundary conditions, a transversality condition, determining the extent of the detached region. The results indicate that the ring will not buckle unless external disturbances are present. A discussion of energy barriers shows that the ring's ability to sustain external disturbances diminishes as the contraction increases. Author (GRA)

N71-21807# Missouri Univ., Columbia. Dept. of Civil Engineering.
STATIC AND FATIGUE PROPERTIES OF HIGH STRENGTH BOLT SHEAR CONNECTORS Final Report
Lawrence N. Dallam Jun. 1970 57 p refs Sponsored in part by DOT *Its* Study 68-4
(PB-196592; Rept-70-2) Avail: NTIS CSCL 13M

A summary is presented of the static and fatigue study of continuous composite bolted beams to determine the static and fatigue properties of high strength bolts when used as shear connectors in concrete-on-steel composite beams. In addition, the design recommendations for shear transfer and allowable design load are summarized. GRA

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N71-20606# Los Alamos Scientific Lab., N.Mex.
TEPLO: A HEAT CONDUCTION CODE FOR STUDYING THERMAL EXPLOSIONS IN LAMINAR COMPOSITES
C. A. Anderson Aug. 1970 44 p refs
(Contract W-7405-eng-36)
(LA-4511) Avail: NTIS

The Crank-Nicolson finite difference method is used to determine the one-dimensional heat flow in slab, cylindrical, and spherical geometry of reactive solids obeying zero-order kinetics and

with temperature-dependent thermal properties. Temperature, flux, or convective boundary conditions can be handled by TEPLO, for which the initial conditions can be taken in exponential form. The method is valid for solids composed of up to 10 materials with different thermal properties. One phase change is permitted in each layer of the composite. The inherent stability of the Crank-Nicolson method and the incorporation of time-step adjustment in TEPLO significantly reduce the computing time for most problems with little loss in accuracy. The small number of data cards and the availability of several plotting options for LASL's CDC 6600 computers allow TEPLO to be readily used. Author (NSA)

N71-20656 National Physical Lab., Teddington (England). Div. of Chemical Standards.
EVALUATION OF THE THERMODYNAMIC PROPERTIES OF III-V COMPOUNDS
A. S. Abbasov. Nov. 1970 11 p refs
(NPL-DCS-8) Copyright. Avail: Issuing Activity

An assessment is made of the thermodynamic properties (heat of formation, fusion, and entropy) of solid and liquid indium-antimony, indium-arsenic, gallium-antimony and gallium-arsenic. The evaluation shows that the third law is applicable to these compounds. ESRO

N71-20702# Dynamic Science, Irvine, Calif.
FLIGHT VIBRATIONAL AND ENVIRONMENTAL EFFECTS ON FORMATION OF COMBUSTIBLE MIXTURES WITHIN AIRCRAFT FUEL TANKS Final Report, 23 Jun. 1969 – 31 Mar. 1970
T. C. Kosvic, N. L. Helgeson, and B. P. Breen Sep. 1970 87 p refs
(Contract DAAJ02-69-C-0063)
(AD-875901; SN-162-F; USAAVLABS-TR-70-43) Avail: NTIS CSCL 21/2

The objective of the study was to determine fuel tank vapor space characteristics for a simulated helicopter fuel tank and to evaluate the potential hazard which exists. Fuel/air ratios were measured as a function of time and position within the ullage of the fuel tank for specified flight profiles. These results were compared to published flammability limits as a basis for assessing flight hazard potential. The flight profiles were simulated by withdrawing fuel at rated engine usage from a vibrating tank held at constant pressure and temperature. Parametric variations were made in fuel temperature 40 to 100 F, flight altitude 0 to 15,000 feet, vibration environment, and fuel properties Liquid JP-4 versus JP-4 emulsion EF 4-104 H. Another important variable not considered initially but which was uncovered during the course of this investigation was the effect that the rubberized tank liner could have on the measured fuel/air ratios. The extent of this effect was found to be related to fuel temperature and exposure time of the liner to the fuel. The experimental results showed those ranges of the test variables which had a significant effect on the measured fuel/air ratios. They also demonstrated that fuel/air mixture gradients do exist in fuel tanks under flight conditions. It was found that tanks which would be considered safe as determined by calculations for equilibrium conditions actually contain flammable regions, even for level flight. An analytical model for the ullage space was written which included transient fuel vapor diffusion and convection which was brought about by venting of the ullage. (GRA)

N71-20724# Mound Lab., Miamisburg, Ohio.
THERMAL DIFFUSION COLUMN COEFFICIENTS FOR THE SEPARATION OF (N 14)2-(N 14) (N 15) AND (O 16)2-(O 16) (O 18)
K. J. Kaminsky, W. M. Rutherford, and M. S. Willis 23 Dec. 1970 127 p refs Revised
(Contract AT(33-1)-Gen-53)
(MLM-1439-Rev) Avail: NTIS

The thermal diffusion column coefficients of the Jones and Furry theory were compared to coefficients obtained from experiments dealing with the separation of the (N-14)2-(N-14)(N-15) and the (O-16)2-(O-16)(O-18) systems. The thermal diffusion column transport equation was developed from general kinetic theory expressions which describe the mass flux resulting from concentration and temperature gradients. This equation contains collections of integrals which are represented by the column coefficients. In order to evaluate the column coefficients from theory, the temperature dependence of the viscosity, thermal conductivity, diffusivity, and thermal diffusion factor must be known. A complete set of smoothed experimental transport properties of N2 and O2 between 200 and 1100 K was obtained. Column coefficients for the experimental conditions were evaluated on the basis of these properties. Author (NSA)

N71-20755# Denver Univ., Colo. Dept. of Chemical Engineering.
HEAT TRANSFER DURING MELT SPINNING
W. H. Wanger and V. G. Fox [1971] 36 p refs
Avail: NTIS

Models for heat transfer within single fibers and from a single fiber to the surrounding fluid are critically reviewed. Published temperature-vs-distance data is surveyed and compared with various mathematical models. Author

N71-20757# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADIATIVE CONVECTIVE HEAT TRANSFER OF A HIGH TEMPERATURE FLOW OF A GAS IN A CHANNEL
V. N. Andryanov et al 14 Oct. 1970 29 p refs Transl. into ENGLISH from the book "Teploobmen v Elementakh Energ. Ustanovok" Moscow, 1966 p 134 – 150
(AD-716978; FTD-HC-23-534-70) Avail: NTIS CSCL 20/13

The article is devoted to a combined theoretical and experimental treatment of the problem of complex-heat transfer between a high temperature gas flow and the cold surface of a channel. The theoretical analysis arrives at a method for determining the quantities which enter into the dimensionless relationship describing the process. For the experimental investigation, a special apparatus was built to study radiative-convective heat transfer during the movement of the products of the combustion of a gaseous fuel in cylindrical channels. The article gives a diagram of the experimental apparatus. Four series of experiments were carried out in channels of different diameters. The experimental results are exhibited in extended tables. On the basis of the experimental data, a given relationship was arrived at. Author (GRA)

N71-20769# Centre National de la Recherche Scientifique, Meudon (France). Lab. d'Aerothermique.
STUDY OF TEMPERATURE DISTRIBUTION IN HIGH POROSITY MEDIA DURING EVAPORATION IN SITU [ETUDE DU CHAMP DES TEMPERATURES AU COURS DE L'EVAPORATION PROFONDE DANS UN MILIEU DE GRANDE POROSITE]
Mohamed Salah Sifaoui Jul. 1970 77 p refs In FRENCH
(Rept-70-6) Avail: NTIS

The experimental method used to ascertain the temperature distribution of porous materials fed from below with water and presenting an evaporative interface is described. Results are discussed and compared with those of previous methods. ESRO

N71-20834* Avco Corp., Wilmington, Mass.
METHOD AND APPARATUS FOR MAKING A HEAT INSULATING AND ABLATIVE STRUCTURE Patent
Robert W. King, inventor (to NASA) and Roy W. West, Jr. Issued 31 Oct. 1967 (Filed 12 May 1965) 6 p Cl 141-5 Sponsored by NASA

(NASA-Case-XMS-02009; US-Patent-3,349,814; US-Patent-Appl-SN-455352) Avail: US Patent Office CSCL 20M

A method and apparatus are described for uniformly filling an open celled heat shield matrix, having a number of honeycomb cells, with a fibrous, highly flow-resistant insulating material. The gun containing the insulating material is placed over the cell to be filled, by a plate with pins which fit into and support the adjacent cells of the matrix. The material is carried into the cell by gas which is supplied under pressure to the gun. After the material is deposited in the cell, the gas is exhausted from a venting opening in the lower end of the cell.

Official Gazette of the U.S. Patent Office

N71-20860*# Case Western Reserve Univ., Cleveland, Ohio. Div. of Fluid, Thermal, and Aerospace Sciences.

CONDENSATION HEAT TRANSFER OF LOW PRESSURE METAL VAPORS

Yun-Seng Huang, Frederic A. Lyman, and Wilbert J. Lick Jan. 1971 67 p refs

(Grant NGR-36-003-064)

(NASA-CR-117429; FTAS/TR-70-54) Avail: NTIS CSCL 20M

The film condensation of low pressure metal vapors on isothermal vertical flat plates or tubes is considered. The liquid film has been treated as a thin layer in which the acceleration and pressure forces are negligible and across which the temperature distribution is linear. The average behavior of the vapor has been found from the linearized one dimensional vapor flow equations. A consistent distribution function has been determined for the vapor particles at the liquid-vapor interface. A set of algebraic equations is formed from which one can predict the condensation rate of low pressure metal vapors. There is good agreement between the most recent and reliable experimental data and the present theoretical calculations if the presence of a small amount of a noncondensible gas is included.

Author

N71-20931# Bureau of Mines, Washington, D.C.

PHOTOCHEMICAL REACTIVITY OF DIESEL EXHAUST: SOME PRELIMINARY TESTS

B. Dimitriades and H. B. Carroll, Jr. Apr. 1971 9 p refs

(BMRI-7514) Avail: Issuing Activity

Exploration of the photochemical reactivity of diesel exhaust hydro-carbons is described. A smog chamber was built, and reactivities of diesel exhaust, gasoline exhaust, and propylene were measured at two chamber temperatures. Experimental data indicated the problems caused by instability of diesel exhaust hydrocarbons. With reservations due to these problems, the results are interpreted to reflect comparable reactivities for diesel and gasoline exhaust.

Author

N71-20938# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

AN ANALYSIS OF OBLIQUE AND NORMAL DETONATION WAVES

L. H. Townend London Aeron. Res. Council 1970 45 p refs Supersedes RAE-TR-66081; ARC-28317

(ARC-R/M-3638; RAE-TR-66081; ARC-28317) Copyright. Avail: NTIS; HMSO: £1.10; BIS: $4.05

Plane detonation waves are analyzed, on the assumption that the ratio of specific heats and the molecular weight are constants. Heat release is quoted in terms of a dimensionless parameter F, such that, for Chapman-Jouguet detonations F = 1, for any strong detonation 1 less than F less than 2, and for shock waves F = 2. Wave properties are shown to be functions either of heat release and the component of upstream Mach number normal to the wave, or of heat release and both normal and streamwise components of upstream Mach number. The expressions can be used to generalize existing programs for flows with two dimensional or axisymmetric shock waves; they thus allow computation of two dimensional or axisymmetric flow fields formed between a body and a detonation wave.

Author (ESRO)

N71-20943*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THE PRACTICAL USE OF MAGNETIC COOLING

G. V. Brown [1971] 10 p refs Proposed for presentation at Intern. Congr. of Refrig., Washington, D.C., 27 Aug.–3 Sep. 1971; sponsored by NAS-NRC

(NASA-TM-X-52983) Avail: NTIS CSCL 20M

The results are presented of a study to determine the feasibility of an idealized paramagnetic system for magnetic cooling. The findings indicate that: (1) the use of high-field large-volume superconducting magnets removes constraints that previously confined magnetic cooling to LHe temperatures; (2) magnetic fields of up to 15 T can significantly order a paramagnetic system as high as about 50 K; (3) a magnetic refrigerator could be an alternative to the gas working fluid refrigerator, which has low mechanical efficiency at low temperature; (4) Several other devices in applied magnetic fields appear practical such as a magnetic sorption pump for helium or hydrogen vapor, a regenerator for temperatures below 20 K, and an adjustible isothermal heat source or heat sink; and (5) the useful temperature range of some of these devices may be extended higher by using ferromagnetic materials above their Curie points.

Author

N71-21168*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THERMODYNAMICS OF THE HEISENBERG FERROMAGNET IN AN APPLIED MAGNETIC FIELD

Lawrence Flax 1971 11 p refs Presented at Am. Phys. Soc. Meeting, Cleveland, 29 Mar.–1 Apr. 1971

(NASA-TM-X-52989; E-6216) Avail: NTIS CSCL 20M

The anisotropic Heisenberg ferromagnet formalism developed previously is examined to include an applied magnetic field for the isotropic case in the random phase approximation. Thermodynamic quantities such as magnetization, susceptibility, and the derivative of magnetization with respect to temperature are studied near the Curie point.

Author

N71-21189*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PRELIMINARY RESULTS OF TESTING A SINGLE TUBE POTASSIUM BOILER FOR THE ADVANCED RANKINE SYSTEM

Martin U. Gutstein and James A. Bond (GE, Cincinnati, Ohio) Mar. 1971 20 p refs Prepared by GE, Cincinnati, Nucl. Systems Programs

(Contract NAS3-9426)

(NASA-TM-X-52996) Avail: NTIS CSCL 20M

In support of the technology for the advanced Rankine nuclear electric power plant for space, a lithium-heated single-tube potassium boiler was tested at exit saturation temperatures as high as 1420 K. A sample is presented of the results obtained, including a temperature distribution in the boiler, the variation of boiler pressure losses with potassium flow rate, and average potassium boiling heat transfer coefficients for a range of exit qualities and exit superheats. One transient test, simulating the startup of the advanced system, is described. The success of the boiler testing represents a major advance in the technology for high-temperature liquid-metal space power systems.

Author

N71-21201*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A COMPARISON OF EXPERIMENTAL HEAT TRANSFER COEFFICIENTS IN A NOZZLE WITH ANALYTICAL PREDICTIONS FROM BARTZ'S METHODS FOR VARIOUS COMBUSTION CHAMBER PRESSURES IN A SOLID PROPELLANT ROCKET MOTOR

Dewey M. Smith (M.S. Thesis - N.C. State Univ.) 1970 97 p refs
(NASA-TM-X-66997) Avail: NTIS CSCL 20M

Heat transfer coefficients in the nozzle of a small solid propellant motor are compared to the predictions from Bartz's Nusselt number correlation equation and technique of solving the boundary layer momentum and energy equations simultaneously for the heat transfer coefficient. The propellant was a composite of ammonium perchlorate and polybutadiene acrylic acid and the average motor chamber pressures were 220, 410, and 742 psia. Measurement locations were at a local to throat area ratio of 1.785 in the convergent section, at the throat and at a local to throat area ratio of 2.369 in the divergent section for the chamber pressures of 220 and 410 psia. Results show that the experimental data for the convergent region and throat were consistently lower than Bartz's predictions. The experimental data in the divergent sections could be correlated by evaluating the skin friction coefficient at the free stream temperature and using it in the simultaneous solution. Author

N71-21202# Armed Services Explosives Safety Board, Washington, D.C.
MINUTES OF THE EXPLOSIVES SAFETY SEMINAR
Aug. 1970 536 p refs Conf. held at Memphis, Tenn., 25 - 27 Aug. 1970
(AD-716790) Avail: NTIS CSCL 19/1

Contents: Transportation of hazardous material; New applications of ammonium nitrate slurry explosives; Safety tests of explosives transport trucks; Containerization of explosives; Explosive classification and hazard evaluation of pyrotechnic compounds under transport, processing and storage conditions; Grounding of explosives loading and storage facilities; Automation of defuzing operations; Explosives hazard classification procedures; Hazards of plastic packaging materials, and Possible solutions to environmental pollution associated with distruction of ammunition and explosives. GRA

N71-21279*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
TEMPERATURE DISTRIBUTION OF A THIN-WALLED, TRANSPARENT, SPHERICAL, EARTH SATELLITE
Joseph T. Skladany Washington Mar. 1971 33 p refs
(NASA-TN-D-7035; G-1008) Avail: NTIS CSCL 20M

An expression is derived for the temperature distribution of a transparent, spherical earth satellite. Lateral and radial conduction are assumed negligible, and a steady-state condition at a fixed point in orbit is assumed for the satellite. The thermal radiation heat balance problem is solved in a closed form by a radiosity method, somewhat modified to include the transmittance of the satellite skin, and solar and earth radiation as external inputs. A general solution which consists of three simultaneous integral equations at each node and holds for any shape enclosure is derived for skin temperatures. The spherical shape is then introduced and expressions for mean skin temperature and the temperature at any point on the sphere are obtained. Three numerical examples are included, two opaque and one transparent, to illustrate the use of the derived expressions and point out the differences in temperature distribution between opaque and transparent spheres. Author

N71-21292 Tulane Univ., New Orleans, La.
NONINTERACTING CONTROL OF A DISTRIBUTED PARAMETER PROCESS: THE DOUBLE PIPE HEAT EXCHANGER
Stephen Samuel Melsheimer (Ph.D. Thesis) 1969 195 p
Avail: Univ. Microfilms: HC $8.80/Microfilm $3.00 Order No. 70-6410

The feasibility of applying noninteracting control technology, based as it is on lumped parameter dynamics to a realistic and representative distributed parameter process is discussed. The system utilized was a double pipe heat exchanger. The approach taken was the representation of the heat exchanger system dynamics by means of transfer functions. These were obtained by pulse testing and regression so as to ensure a good fit to the system response. A state space realization of the system was obtained from the transfer matrix model. These system models were then used in designing noninteracting control systems using the two basic design methodologies, the Laplace domain transfer function technique and the time domain state variable procedure. The latter was substantially modified so as to allow deterministic treatment of the pure time delays which naturally arise in distributed parameter process dynamics. Dissert. Abstr.

N71-21316*# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
COMBUSTION INSTABILITY RESEARCH Summary Report, 1970
L. Crocco, D. T. Harrje, W. A. Sirignano, F. V. Bracco, J. Lorenzetto et al Feb. 1971 84 p refs
(Grant NGL-31-001-155)
(NASA-CR-72848; AMS-972) Avail: NTIS CSCL 21B

Studies concerned with improving the understanding and control of combustion instability in liquid rocket engines are reported. The topics include: damping devices employing quarter-wave tubes and Helmholtz resonators, mass energy sources as investigated with a shock tube technique, unsteady diffusion flame studies relating to droplet and wave phenomena, the evaporization model as applied to the annular chamber, and a hydrogenation rocket feasibility study. Emphasis is placed on recent results and progress on each phase. Author

N71-21382# Physics International Co., San Leandro, Calif.
A FEASIBILITY STUDY OF NUCLEAR FIREBALL SIMULATION Final Report
D. W. Baum and S. P. Gill Nov. 1970 52 p refs
(Contract DASA01-69-C-0123)
(AD-717090; PIFR-157; DASA-2543) Avail: NTIS CSCL 18/3

The report describes the initial phase of an experimental program designed to assess the feasibility of simulating the thermal environment of a high-temperature nuclear fireball. A high-performance, explosively driven shock tube is used to produce temperatures from 10,000 K to 100,000 K in xenon gas. The Boltzmann number and optical depth in the gas are chosen to match the fireball environment. Radiative energy transfer dominates conductive and convective processes in a nuclear fireball (as measured by the Boltzmann number), so that it is possible to achieve fireball simulation with a gas other than air. Xenon was chosen for its thermodynamic compatibility with state-of-the-art explosively driven shock tubes. The fireball simulator is primarily useful in providing a definitive experimental test of prediction codes for fireball thermal effects, for obtaining data on the energy-transport properties of ablated surface materials, and for developing and testing fireball instrumentation concepts. Author (GRA)

N71-21471 Tulane Univ., New Orleans, La.
DYNAMIC IMPLICATIONS OF THE TRADITIONAL CRITERIA FOR STABILITY OF EQUILIBRIUM STATES
Bennett Richard Bass (Ph.D. Thesis) 1969 291 p
Avail: Univ. Microfilms: HC $13.30/Microfilm $3.75 Order No. 70-6377

Recognizing that a physically meaningful stability criterion must have its foundations in kinetic principles, the following question is posed: If a continuous or finite-degree-of-freedom system is stable in the energy, adjacent equilibrium, or Gibbs' sense under what circumstances does this imply that the system is stable in the dynamic sense? The dynamic stability criteria which focus on the growth and decay of disturbances with time are employed to

investigate the existence and significance of the dynamic foundations of the traditional criteria. In particular, the extension of Lyapunov's theory to continuous systems as developed by Movchan is used to embed the static energy and Gibbs criteria into a dynamic structure. The adjacent equilibrium criterion is found to have dynamic significance through its relation to the energy criterion. Dissert. Abstr.

N71-21505# Lockheed Missiles and Space Co., Palo Alto, Calif.
INVESTIGATION OF THE PRESSURE LOSS IN GAS REFRIGERATING MACHINES
E. I. Mikulin et al [1970] 5 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Mashinostro. (Moscow), no. 11, 1970 p 86-90
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A two-stage gas refrigerating machine and the influence of the pressure loss on cold production are considered herein. A method is presented for indicating the working cavities by using piezoceramic transducers. Data on the resistance of the gas channels are obtained as a result of experimental investigation. A method is proposed for taking account of the pressure loss in determining the theoretical cold production. Theoretical and experimental results are compared. Author

N71-21506# Lockheed Missiles and Space Co., Palo Alto, Calif.
TEMPERATURE DISTRIBUTION IN LAMINAR FLUID FLOW WITH RADIATION-CONVECTION HEATING
V. V. Ivanov et al [1970] 4 p Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Energ. i Transp. (Moscow), no. 3, 1970 p 171-173
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Laminar fluid flow in a channel with zero thermal wall resistance is examined during simultaneous radiation and convection heating due to an external high-temperature gas medium. To find the temperature distribution in the fluid flow, a linearizing transformation is utilized which reduces the nonlinear boundary condition to a boundary condition of the third type. Author

N71-21507* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CONTROL OF TRANSVERSE INSTABILITY IN ROCKET COMBUSTORS Patent
Marcus F. Heidmann and Charles E. Feiler, inventors (to NASA) Issued 17 Oct. 1967 (Filed 9 May 1967) 6 p Cl. 60-243
(NASA-Case-XLE-04803; US-Patent-3,347,046; US-Patent-Appl-SN-638194) Avail: US Patent Office CSCL 21B

Combustion is dynamically stabilized by opposing or correcting against oscillation at its inception by detecting a spinning oscillation and initiating a tangential velocity in the opposite direction. This is accomplished either by changing the vector direction of the propellant as it is injected into the combustion chamber or by tangentially injecting a portion of the propellant. Official Gazette of the U.S. Patent Office

N71-21557*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMAL ANALYSIS OF CUSTOMIZED MULTILAYER INSULATION ON AN UNSHROUDED LIQUID HYDROGEN TANK
William R. Johnson and Glen R. Cowgill Washington Mar. 1971 54 p refs
(NASA-TN-D-6255; E-5763) Avail: NTIS CSCL 20M

An analytical investigation was conducted to determine the space hold thermal performane of various multilayer insulation configurations on the upper half of a liquid hydrogen tank that was continuously oriented so as to always be in the shadow of the vehicle payload. The results show that the thermal performance achieved with a constant-thickness system can be significantly improved by varying the insulation thickness, using high conductivity shields, and selectively increasing the surface emissivity. The degree of improvement realized was a direct function of the thermal conductivity normal to the insulation blanket. Author

N71-21586* National Aeronautics and Space Administration. Langley Research Center, Langely Station, Va.
ABLATION SENSOR Patent
Peter J. Le Bel, inventor (to NASA) Issued 12 Dec. 1967 (Filed 17 Jun. 1965 4 p Cl. 73-86
(NASA-Case-XLA-01794; US-Patent-3,357,237; US-Patent-Appl-SN-464880) Avail: US Patent Office CSCL 20M

An ablation sensor for measuring the char layer interface recession rate of a charring ablator is described. The sensor consists of two wires embedded in the ablation material at a predetermined level. When the char layer recedes to this level, it electrically connects the embedded ends of the wires. An electrical circuit connected to the other wire ends senses the connection process. A series of the sensors stepped in depth in the ablation material allows for recession rate measurement of the char layer interface. E.C.

N71-21644# Lockheed Missiles and Space Co., Palo Alto, Calif.
HEAT FLUX THROUGH A SURFACE FOR A PERIODIC CHANGE IN TEMPERATURE OF THE MEDIUM
A. M. Arkharov et al [1970] 4 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mashinostro. (Moscow), no. 12, 1970 p 76-78
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

An exact solution is given of the problem of the heat passing through a heat-exchange surface for a harmonic change in the medium temperature. The error of approximate calculations in determining the heat flux for surfaces of different shape is estimated. Author

N71-21652 National Lending Library for Science and Technology, Boston Spa (England).
THE dc ARC TEMPERATURE BETWEEN METAL ELECTRODES IN AN ARGON ATMOSPHERE [TEMPERATURA DUGI POSTOYANNOGO TOKA MEZHDU METALLICHESKIMI ELEKTRODAMI, GORYASHCHEI V ATMOSFERE ARGONA]
E. L. Raff Sep. 1970 3 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (USSR), no. 6, 1958 p 77-78
(NLL-RTS-6099) Avail: Natl. Lending Library, Boston Spa, Engl.: 6s; 1 NLL photocopy coupon

Summary: The arc plasma temperature measured from the ion lines of titanium was shown to be 6100 K using a graphical method. The temperature was not measured from the ion lines of iron because the transition probabilities of these lines were incorrectly calculated. The temperature was measured in a low-ampere dc arc between iron and copper electrodes in an atmosphere of chemically pure argon (0.27% nitrogen and 0.05% oxygen content) at pressure of 770 mm Hg. Author

N71-21688 Missouri Univ., Columbia.
HEAT TRANSFER TO A FLOW IN A ROTATING TUBE
John Edward McElhiney (Ph.D. Thesis) 1969 386 p
Avail: Univ. Microfilms: HC $17.55/Microfilm $4.95 Order No. 70-6802

The effect of the tube wall rotation on the heat transfer from the tube wall to a cooling water stream is considered. Both a theoretical and an experimental approach to the problem are included. The theoretical approach provides a solution for heat transfer from a constant temperature of the outside wall to a flow

developing from a uniform axial velocity distribution to a parabolic distribution in the entrance region of a rotating tube. A numerical solution of the finite difference analogs of three equations involving the concepts of stream function, vorticity, and angular momentum is given. Average fluid properties and axial symmetry are assumed in the formulation of the problem. Experimental measurements are made for the heat transferred to the cooling water in a horizontal rotating condenser tube. Steam is used as a condensing medium on the outside of a 0.739 in. I.D. tube. The theoretical solution does not predict the degradation in the heat transfer observed experimentally. Dissert. Abstr.

N71-21687 National Lending Library for Science and Technology, Boston Spa (England).

TEMPERATURE CONDITIONS IN SOLID BODIES SUBJECTED TO SIMULTANEOUS RADIATION AND CONVECTION EFFECTS [TEMPERATURNYI REZHIM TVEROYKH TEL PRI SOVMESTNOM VOZDEISTVII RADIATSII I KONVEKTSII]

V. V. Salomatov Aug. 1970 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Energ. i Trans. (Moscow), no. 4, Jul.–Aug. 1969 p 91–99

(NLL-RTS-6022) Avail: Natl. Lending Library, Boston Spa, Engl.: 24s; 4 NLL photocopy coupons

The problem of non-steady state heat propagation in solid bodies with simultaneous radiant and convective heat flows is capable of exact analytical solution in quasi-steady state stages. The initial stage is evaluated by means of an approximate relation obtained by the method of Carman and Pohlhausen from the boundary-layer theory. Nomograms are proposed for an accelerated calculation of the dynamics of the heating process. Author

N71-21691 Pennsylvania Univ., Philadelphia.

LOW TEMPERATURE SPECIFIC HEAT STUDY OF MAGNETIC ALLOYS. 1: MECHANISM FOR FIRST ORDER MAGNETIC TRANSITION IN Fe-Rh SYSTEM. 2: SPECIFIC HEAT OF DILUTE MAGNETIC Cu-Mn ALLOYS

Pei-Chun Tu (Ph.D. Thesis) 1969 161 p

Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 70-7872

The mechanisms of the magnetic transition in the Fe-Rh system and the magnetic specific heat of the dilute alloys of Mn in Cu are studied by specific heat experiments at liquid helium temperatures. Fe-Rh alloys containing 50 to 64 at.% Rh exhibit a first order phase transition from the antiferromagnetic state to the ferromagnetic state as the temperature is increased. The transition temperature varies with the concentrations of Rh and many other modifying elements. The entropy change at the transition has been reported to be mainly of magnetic origin, and approximately proportional to the transition temperature up to about 500 K. This nearly linear temperature dependence of the entropy change at the transition suggests that the change in the electronic density of states between the two magnetic phases may be the main driving mechanism for the transition. The low temperature specific heat data show that the ferromagnetic state has indeed a larger electronic density of states than that of the antiferromagnetic state. In terms of the electronic density of states, the magnetic transition can be understood through free energy considerations. Dissert. Abstr.

N71-21726# Westinghouse Electric Corp., Pittsburgh, Pa. Nuclear Energy Systems Div.

PWR FLECHT (FULL LENGTH EMERGENCY COOLING HEAT TRANSFER) GROUP 2 TEST REPORT

F. F. Cadek, D. P. Dominicis, and R. H. Leyse Sep. 1970 226 p refs

(Contract AT(10-1)-1230)

(WCAP-7544) Avail: NTIS

The group 2 test series extended the range of initial temperatures, flooding rates and flow blockages investigated, and examined the effects of power decay rate, variable flooding rate, and entrained water fallback. The test results include transient heat transfer coefficients and clad temperatures at different radial and axial locations. Typical axial and radial pressure drop data, local coolant temperature data and measurements of carry-over water are also presented. The results of this test series provide further verification of the ability of bottom flooding emergency core cooling systems to terminate the temperature increase during a loss-of-coolant accident. In particular, it has been shown that the effects of a variable flooding rate can be predicted, using constant flooding rate data; that reactor fallback will significantly reduce second peak temperatures; and that complete blockage of as many as sixteen adjacent channels will not significantly impair bottom flooding emergency core cooling system effectiveness. Author (NSA)

N71-21783# California Univ., Berkeley.

GASDYNAMICS OF EXPLOSIONS Final Report, 1 Oct. 1969 – 30 Sep. 1970

A. K. Oppenheim Oct. 1970 7 p refs

(Grant AF-AFOSR-129-67)

(AD-717188; AFOSR-70-2933TR) Avail: NTIS CSCL 19/4

The objective of the program is the acquisition of knowledge on the interrelationship between the high rate processes of heat release and the non-steady gasdynamic phenomena that are at the core of such high power energy conversion systems, providing thus the fundamental background for their development. Author (GRA)

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N71-20647# Joint Publications Research Service, Washington, D.C.

THE SITUATION AND ITS MODEL

St. Bir 10 Mar. 1971 12 p Transl. into ENGLISH from Nauka i Zhizn' (Moscow), no. 12, 1970 p 58 65

(JPRS-52580) Avail: NTIS

The science of control and problems connected with modeling a given dynamic situation to be controlled are discussed. Conceptual and scientific models, and models as means of modeling are described. Two applications of modeling for establishing the correct solution are identified as formulation of preferable strategies and creation of viable control. N.E.N.

N71-20673# Royal Netherlands Aircraft Factories Fokker, Amsterdam.

MEASUREMENT ON THE EFFECTS OF VACUUM OR RADIATION ON POLYMERS Progress Report No. 2

P. C. Van Der Waal and P. Rouppe Van Der Voort 13 Oct. 1969 19 p

(Contract ESTEC-647-69-AA)

Avail: NTIS

The technical progress of the program on vacuum and ultraviolet radiation effects on polymers at the Delft Facility for the period from 1 July to 30 September 1969 is summarized. The operational problems are listed. The planning for the period from 1 October to 31 March 1970 is also given. Finally the costs are estimated. ESRO

N71-20770# Norwegian Computing Center, Oslo (Norway).
PLANNING THE LAYOUT, EQUIPMENT MANNING, AND OPERATIONS OF A WAREHOUSE
Jan Evensmo 1970 16 p refs
Avail: NTIS

The problems connected with warehouse projecting and the importance of evaluating the operating characteristics and costs of different warehouse alternatives at the planning stage are dealt with. It is shown that computer simulation is a very useful tool in the projecting, particularly when a computer simulation language like SIMULATM is used. Examples of computer printouts are shown, and the importance of these as a communication channel between programmers, consultants, and directors is highlighted. The simulation technique led to a solution with a substantial saving compared with the solutions which otherwise would have been chosen. Author (ESRO)

N71-20787# European Space Research Organization, Paris (France).
THE FUTURE EUROPEAN SPACE ORGANIZATION
H. K. Kaltenecker 1970 8 p Presented at the 4th EUROSPACE US-European Conf., Venice, 22–25 Sep. 1970
Avail: NTIS

The future European Space Organization with regard to activity field, membership, future programs, structure, financing system, and space policy is briefly described as well as the industrial and contract policy. ESRO

N71-20830# North American Rockwell Corp., Downey, Calif. Space Div.
APPLYING APOLLO TECHNOLOGY TO FUTURE SPACE PROJECTS
W. B. Bergen 1970 44 p Presented at the 4th EUROSPACE US-European Conf., Venice, 22–25 Sep. 1970
Avail: NTIS

Use of experiences gained from the Apollo program for future space projects such as space shuttle and space stations is discussed. It is concluded that management techniques can be adopted to new programs to ensure timely effective implementations. ESRO

N71-20921*# Denver Research Inst., Colo. Industrial Economics Div.
TECHNOLOGY TRANSFER: A SELECTED BIBLIOGRAPHY
Terry Sovel Heller, John S. Gilmore, and Theodore D. Browne Washington NASA Feb. 1971 182 p refs Revised
(Contract NSR-06-004-063)
(NASA-CR-1724) Avail: NTIS CSCL 05B

The purpose of this revised edition is to provide a selective listing of literature on the subject of technology transfer and to identify key literature in the field. It is based on a screening of the available literature. The bibliography is concerned with technology transfer in the following sense: Technology is considered to be technical information and capability, including scientific knowledge, making possible the conception, development, design, production, and distribution of goods and services. Transfer here means the movement of science or technology (in either an embodied form or as information only) from one known place to another. ... Author

N71-21043# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
A DISCRIMINANT ANALYSIS MODEL FOR RATING RESEARCH AND DEVELOPMENT DATA PROGRAMS
Technical Report, 1 Apr. 1969–1 May 1970
Eddie E. Gordhammer, Jr. Oct. 1970 182 p refs
(AD-716812; ASD-TR-70-22) Avail: NTIS CSCL 5/1

The research was initiated to develop and demonstrate a discriminant analysis method for rating technical data associated with Department of Defense (DoD) and National Aeronautics and Space Administration (NASA) research and development programs. In addition, it was designed to identify any differences in the technical data rating philosophies of the participating decision-making groups. The research included a review of the literature associated with research and development rating methods as well as the theory underlying discriminant analysis. The principal data-gathering instruments were two questionnaires. A three-model data evaluation system was developed utilizing the method of discriminant analysis to perform the classification function. The three models operate in tandem to process the questionnaire data, calculate minimum mean estimate (MME) values, compute the necessary linear functions known as discriminant functions, evaluate classification functions, determine the probability associated with the largest discriminant function, and classify new data. The validity of the model was demonstrated by evaluating the technical data program associated with a major DoD weapon system development program. Author (GRA)

N71-21044# Royal Netherlands Aircraft Factories Fokker, Amsterdam.
MEASUREMENT ON THE EFFECTS OF VACUUM OR RADIATION ON POLYMERS Progress Report No. 5
P. C. Van Der Wael and P. Rouppe Van Der Voort 12 Aug. 1970 13 p
(Contract ESTEC-647-69-AA)
(PR-5) Avail: NTIS

The technical progress of the program on vacuum or ultraviolet radiation effects on polymers at the Delft Facility up to 11 July 1970 is presented and a cost specification is given. ESRO

N71-21063# Joint Publications Research Service, Washington, D.C.
DATA RETRIEVAL, PROCESSING, AND EXCHANGE PROCEDURES
19 Mar. 1971 29 p Transl. into ENGLISH from Russian reports (JPRS-52674) Avail: NTIS

An overview is presented on the development of a centralized data processing system in Czechoslovakia. The structure of the system is outlined and discussions are given concerning: (1) the historical beginning and organization of the system, (2) the administration of scientific and technical activities within the country, (3) the creation of a network of branch and specialized data processing centers, (4) state funding and control of the system, (5) the utilization of modern methods and equipment, (6) shortcomings of the system, and (7) the benefits to be gained by collaboration with other countries for the systematic exchange of informational materials. D.L.G.

N71-21088# Joint Publications Research Service, Washington, D.C.
AUTOMATION OF MANAGEMENT
N. Moiseyev 15 Mar. 1971 14 p Transl. into ENGLISH from Nauk. i Zhizn. (Moscow), no. 1, 1971 p 2–7
(JPRS-52623) Avail: NTIS

Automated management systems are discussed for decision making and systems control to meet the demands of the second industrial revolution. Differences between the automation of production and the automation of management are cited. The effects of adopting automatic control systems are considered along with computer programming, personnel training, and centralization of information system problems. E.C.

N71-21094# National Science Foundation, Washington, D.C.
[RESEARCH, SCIENCE EDUCATION, AND INSTITUTIONAL PROGRAMS] Annual Report, Period Ending 30 Jun. 1970
1971 127 p refs
(NSF-71-1) Avail: Issuing Activity

Science research and education support activities during the report period and programs for the coming decade are discussed. The following activities are described: research in individual and interdisciplinary sciences; education programs at elementary through doctoral levels; programs for improving and sustaining science in institutions with graduate schools; computer-aided education and research; marine resources development; science information systems development; and international cooperative programs. The development of basic tools for science planning and policy making is also considered. N.E.N.

N71-21099 Northwestern Univ., Evanston, Ill. Dept. of Industrial Engineering and Management Sciences.

THE RELATIONSHIP OF INTERGROUP ORGANIZATIONAL CLIMATE WITH COMMUNICATION AND JOINT DECISION MAKING BETWEEN TASK INTERDEPENDENT R AND D GROUPS. PART 1

Richard Timothy Barth (Ph.D. Thesis) Aug. 1970 259 p
(Rept-70/34-Pt-1) Copyright. Avail: Issuing Activity

The specific goal of the research reported was to test, based on data obtained through a field study in actual operating research and development organizations, fifteen propositions concerning the effects of intergroup climate, as defined for a given pair of task-interdependent groups, on the level of perceived communication problems experienced by members of the groups dealing with eath other. In each of these propositions, the level of task-interdependence perceived to exist between the groups as taken into account. Several additional propoositions were concerned with: (1) the relationship between perceived communication problems, the primary mode of joint decision making used by the groups, and the quality of coupling achieved; and (2) criteria used by managers when rating the effectiveness of the participating groups. Data for proposition testing were collected from 256 participatns representing 60 working groups in one industrial and nine government R and D laboratiries. Both questionnaires and individual interviews were used to collect the data. Author

N71-21100 Northwestern Univ., Evanston, Ill. Dept. of Industrial Engineering and Management Sciences.

THE RELATIONSHIP OF INTERGROUP ORGANIZATIONAL CLIMATE WITH COMMUNICATION AND JOINT DECISION MAKING BETWEEN TASK INTERDEPENDENT R AND D GROUPS. PART 2

Richard Timothy Barth (Ph.D. Thesis) Aug. 1970 167 p refs
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The data analysis and results are presented of a test, based on information obtained through a field study, of the propositions concerning the effects of intergroup climate on the level of perceived communication problems experienced by members of the groups. Two complementary methods were used for analyzing different sets of the data: multiple regression analysis, and path analysis. Data analysis and proposition testing by these methods are reported in separate sections, and are preceded by a discussion of some of the important characteristics of the methods utilized. Author

N71-21581# General Electric Co., Philadelphia, Pa. Missile and Space Div.

STATEMENT ON FUTURE NATIONAL SPACE POLICY

Daniel J. Fink 9 Oct. 1970 16 p Presented to the Subcomm. on NASA Oversight of the House Comm. on Sci. and Astronaut., US Congr., Washington, 9 Oct. 1970
(PIB-A-59) Avail: Issuing Activity

The accomplishments of the space program including benefits through technology transfer are identified, and recommendations for the future are discussed. The impact of reduced funding due to changing priorities of the public on aerospace industries and universities are mentioned, and it is felt that the values of the space program are inadequately defended. The President's Space Task Group Report is basically supported, but with the priorities reordered somewhat differently. Specifically, it is recommended that there be more emphasis on the exploitation of technology already available, on the evolutionary development of new new large scale objective such as space stations and transportation systems, on extensions of programs such as Skylab, and on the optimization of unmanned/manned capabilities. It is felt that primary emphasis over the near term should be given to unmanned earth application programs, but manned missions are also stressed. The fundamental criteria for manned programs are identified as meaningful-for-man missions, integrated manned/unmanned payloads, and low cost transportation. These are illustrated by the Skylab B program. N.E.N.

N71-21615 National Lending Library for Science and Technology, Boston Spa (England).

PROGNOSTICS: A NEW SCIENCE [PROGNOSTIKA: NOVAYA NAUKA]

D. M. Gvishiani et al Sep. 1970 21 p Transl. into ENGLISH from Buduschee Nauki, Mezhdunar. Ezhegodnik (Moscow), 1970 p 28-48
(NLL-RTS-6095) Avail: Natl. Lending Library, Boston Spa, Engl.: 42s; 7 NLL photocopy coupons

The objectives and methodology of forecasting are discussed along with trends in economic and research and development forecasting. It is emphasized that scientifically-substantiated methods of forecasting must be elaborated as well as a general theory of forecasting based on the concept of dialectical materialism. E.C.

N71-21697# National Air Pollution Control Administration, Raleigh, N.C.

HYDROCARBONS AND AIR POLLUTION: AN ANNOTATED BIBLIOGRAPHY. PART 1: CATEGORIES A TO E. PART 2: CATEGORIES F TO M AND INDEXES

Oct. 1970 1184 p refs
(PB-197165; NAPCA-Pub-AP-75) Avail: SOD $5.00; NTIS CSCL 13B

Approximately 2300 abstracts of technical literature related to hydrocarbons and air pollution are presented. The abstracted literature was collected from sources in the information retrieval system of the Air Pollution Technical Information Center (APTIC). Most of the literature is dated 1959 through 1970. The abstracts are arranged in thirteen subject categories. Four indexes are included: subject, title, author, and geographical location. The author index lists first and second (if any) authors individually. The geographical location index lists includes two sections: United States (states/localities); and foreign (countries/cities). Author (GRA)

N71-21698# Michigan State Univ., East Lansing. Dept. of Sociology.

MANAGEMENT, TECHNOLOGY AND BEHAVIOR OF WORK GROUPS Final Report

Charles A. Drake (Ph.D. Thesis) Dec. 1970 173 p refs
(Grant DL-91-24-69-49)
(PB-196467; DLMA-91-24-69-49(1)) Avail: NTIS CSCL 05I

The impact that technical structure variables of a work setting have on the relationship between supervisory style and the attitudes and behavior of industrial work groups is examined. The research explores the assumption that supervision is an integral part of an organization, and whatever characteristics the organization may have will influence the appropriate style of supervision. The research is based on an examination of 66 groups representing task and technological systems in a large chemical company, including research, legal, patent, manufacturing, industrial relations, controllers, and business information services. A short review of the literature on the structure of influence within organizations is given. Author (GRA)

N71-21784# Esso Research and Engineering Co., Linden, N.J. Government Research Lab.

PROFILE STUDY OF AIR POLLUTION CONTROL ACTIVITIES IN FOREIGN COUNTRIES First Year Report

Homer J. Hall Res. Triangle Park, N.C. Natl. Air Pollution Control Admin. Nov. 1970 810 p refs

(Contract PHS-CPA-22-69-68)

(PB-196841; APTD-0601) Avail: NTIS HC $9.00/MF $0.95

CSCL 13B

Over one thousand organizations dealing with air pollution control activities in 14 countries are included in the context of their functions in each country. Geography, political background, administration and finance of national and local control programs, current interests, proposed control programs, and time tables for meeting goals are described for Austria, Belgium, Switzerland, Denmark, France, Great Britain, Italy, Japan, Norway, Netherlands, Sweden, and Soviet Union with similar descriptions for 19 international organizations. Where applicable publications relating to air pollution are also listed. GRA

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